VOL. 36, NO. 10 OCTOBER, 1959

AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY

EDITOR
CAREL C. KOCH

EDITORIAL COUNCIL
JOHN D. PERRY, JR. Chairman
ROBERT E. BANNON
RUDOLPH EHRENBERG
V. J. ELLERBROCK
BENTON FREEMAN
GLENN A. FRY
ROBERT GRAHAM
MONROE J. HIRSCH
HENRY W. HOFSTETTER
MEREDITH W. MORGAN
HENRY B. PETERS
MAX SCHAPERO
ARTHUR SHLAIFER
KENNETH B. STODDARD
RALPH E. WICK
JOHN ZETTEL

CONTENTS

ORIGINAL PAPERS

Refractive Techniques for the Decreased Vision Problems of the Aged. *Harry Kaplan* 511

Techniques for Stabilization of Cheiroscopic Drawing with Special Reference to Serial Test Stimuli. *Phillip R. Haynes and Cornelia A. Haynes* 519

The Effect of Homatropine Upon Accommodation-Convergence Relations. *Glenn A. Fry* 525

Further Aspects of Blurring and Color Discrimination. *Arthur Shlaifer* 532

The Principles of Tonometry—Impression Tonometers. Part II. *John H. Carter* 538

Preliminary Report of Survey on Interprofessional Referral Methods. *William G. Walton, Jr.* 547

EDITORIALS

OMA Public Relations Program in 1960. *Rudolph Ehrenberg* 555

The Academy's new Home Study Course—An Individual and Group Activity. *Ralph E. Wick* 556

SPECIAL REPORT

Myopia—From the Viewpoint of a Russian Physician. *Israel Dvorine* 557

TRANSACTIONS OF THE ACADEMY

Announcement of Program for American Academy of Optometry Annual Meeting. December 12-15, 1959 Drake Hotel, Chicago. *Donald A. Springer* 563

New Members of Academy 566

Published Monthly by the AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION, 1508 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

ANNUAL SUBSCRIPTION, UNITED STATES and CANADA $8.00; FOREIGN $9.00.
Single Copies, 80c

Second-class postage paid at Minneapolis, Minnesota.
Established 1924.

presenting the NEW.....

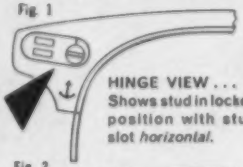
Mainliner

ANCHOR-LOC* DETAIL:

NOTE: Anchor-Loc is identified by the tiny anchor stamped on every frame!

ANCHOR-LOC IN LOCKED AND UNLOCKED POSITIONS:

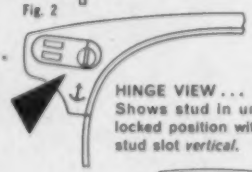
Fig. 1



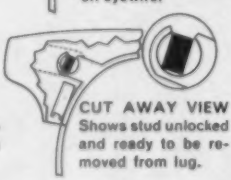
HINGE VIEW . . . Shows stud in locked position with stud slot *horizontal.*

CUT AWAY VIEW Shows oblong stud locked in slotted lug on eyewire.

Fig. 2



HINGE VIEW . . . Shows stud in unlocked position with stud slot *vertical.*



CUT AWAY VIEW Shows stud unlocked and ready to be removed from lug.

PROCEDURE:

To remove top arm, line up Anchor-Loc stud slot with vertical rules on hinge plate. (Fig. 2). Lift up top arm, disengage nasal end, lift off.

To attach, make sure Anchor-Loc stud slot is in vertical position. Then engage nasal end and slide top arm firmly down over chassis. Give stud a quarter-turn to horizontal position and top arm is firmly locked.

REMEMBER: With Anchor-Loc, there are no loose screws or threading problems. The stud remains firmly in place.

*PATENT PENDING

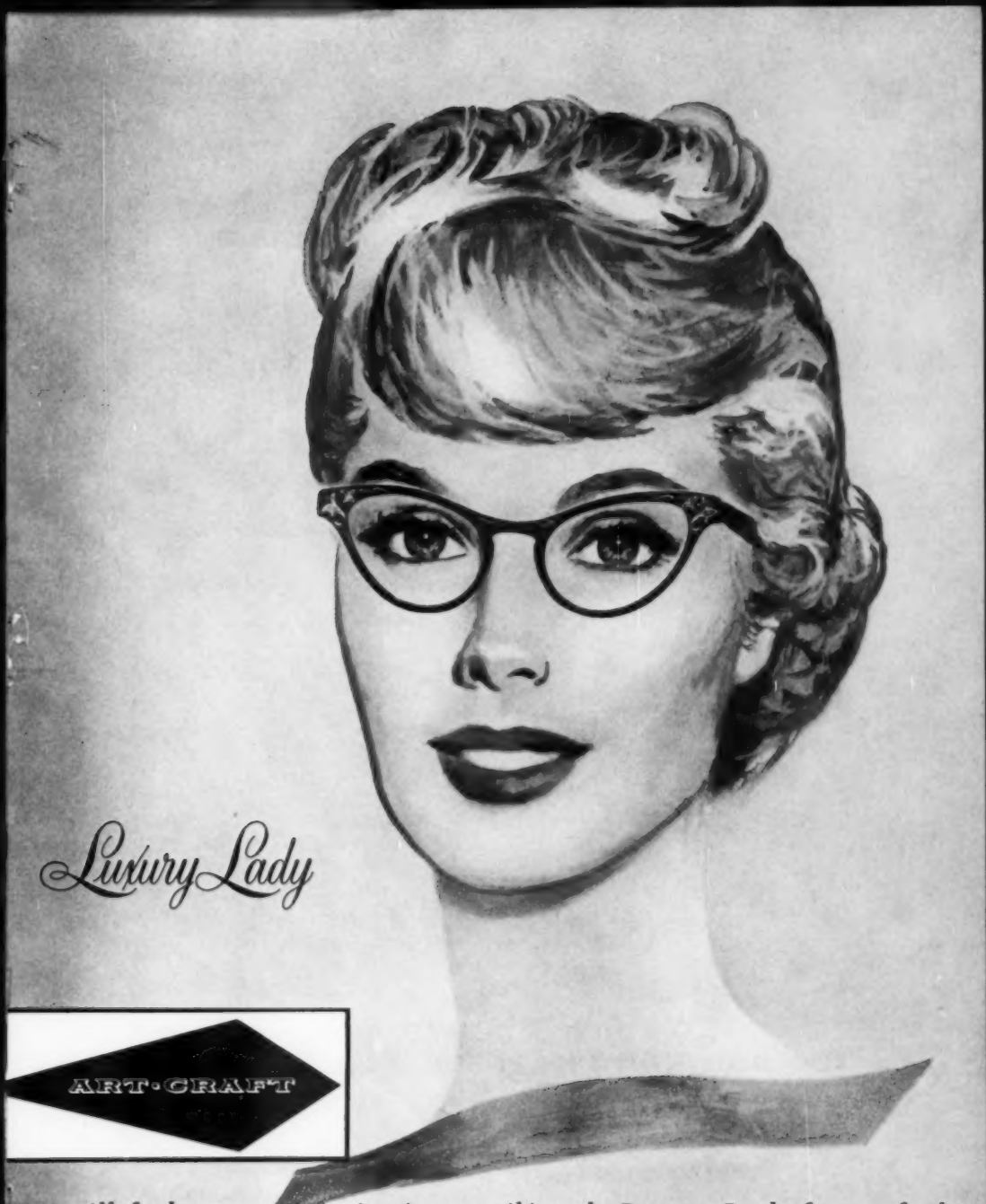
● WITH CONTINENTAL'S UNIQUE TOP ARM LOCKING DEVICE . . . ANCHOR-LOC*

Here it is! Continental's handsome new MAINLINER with 3 exclusive and unique features: ANCHOR-LOC, the *instant* top arm lock that eliminates tiny loose screws and threading problems; HIDDEN HINGE, with its 100% guarantee against front hinge loosening or breakout (also eliminates hinge shields for a clean-cut appearance); and BARRELOC, the eyewire device that does away with loose screws and broken lenses. Note the new bridge design, too! You'll find the MAINLINER has universal appeal . . . from doctors all the way to happy wearers.

Five zyl colors: Dusk Gray, Ebony, Cordovan, Mahogany Briar, Burnt Ash. Note—Briar and Cordovan come with mello chassis. Popular sizes.

Continental

INDIANAPOLIS

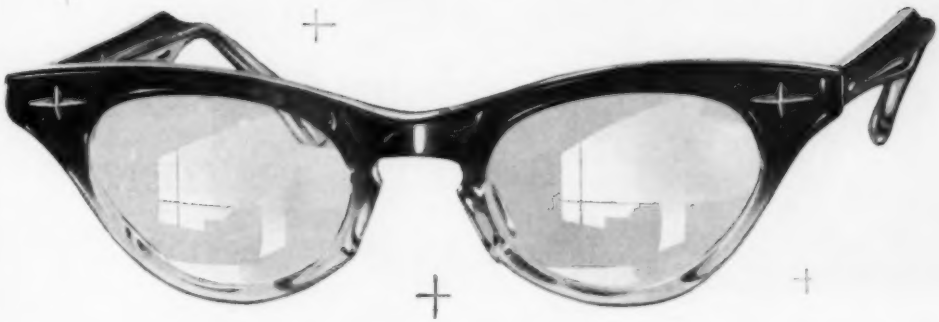


You will find great satisfaction in prescribing the Luxury Lady frame—for here 's a frame of rare beauty, contemporary with today's dress, and with a tasteful richness that compliments your patient. It's a prestige builder!

ART-CRAFT OPTICAL COMPANY, INC. · ROCHESTER 6, N. Y.

the sparkling new Bausch & Lomb frame

Starline



Here's new styling, new comfort. Starline is meticulously engineered. It gets its strength and durability from structural emphasis in the top areas of the front; its daintiness and feathery-light look and fit from tapered-down eyewires, undercut keyhole bridge, and precision flare in the built-up eyewire shoulders. A new lens oval and classic 4-point star plaque lends Starline an elegance distinctly its own. In fashion's new gradient colors: Blue Haze, Smoke Haze and Bronze Haze. See it soon.

with "Engineered Fit-ability"

Frames by BAUSCH & LOMB

RIGHT IN FASHION... RIGHT IN FUNCTION

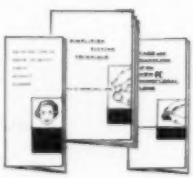
Precision-Cosmet's 25 years of contact lens experience assures you of

GREATER PATIENT SATISFACTION

PC's Nonscleral® Contact Lenses* are produced with minimum thickness to provide maximum patient comfort. Yet, due to PC's exclusive process, lenses are free from strain or warping. PC's process also provides exacting control of lens curvatures assuring finest fit, easing patient adjustment period.

WRITE TODAY for a free copy of PC's helpful illustrated folders on fitting techniques for the doctor and instruction folders for the patient.

**Licensed under litigated Patent No. 2,510,438.*

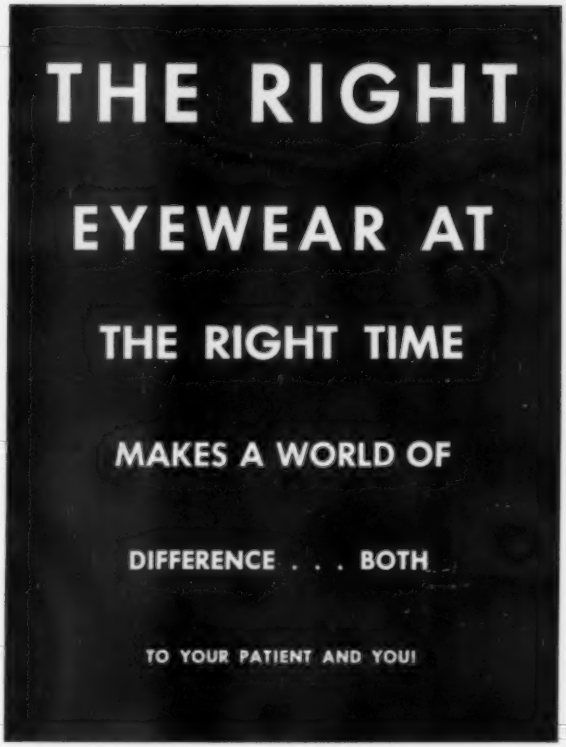


For greater patient satisfaction, send your next Rx to—

Precision-Cosmet Co. Inc.

529 SO. SEVENTH ST. • MINNEAPOLIS 15, MINN • FEDERAL 3-5486

OPTICAL PRODUCTS OF PROVED PERFORMANCE



We bring you this message in the form of a reading card to emphasize that the theme of "right eyewear" does not necessarily refer to style only. It may also — **as it does** — refer to the need to consider the patient's visual welfare in the light of his vocational, as well as general, needs.

A shoe clerk wouldn't sell you a pair of low-cut oxfords for mountain-climbing; he knows there are different shoes for different uses. Likewise, your patient should be made aware that there are frames and lenses designed for specific tasks, so that he might have the proper eyewear for both work and leisure.

We agree that if more pairs of glasses were dispensed as a result of a more intensive interpretation of the patient's needs, the sponsors of "right eyewear" messages would benefit, but what's wrong with that? **Far more vital is the fact that the patient's visual requirements would be better served.**

We urge that you consider the patient's **needs**, not his pocketbook; **he** will look to that. And speaking of pocketbooks, have **you** considered budget financing to cover this aspect of your practice? Your local bank can supply you with information on budget financing for professional men, or you may obtain details through your local or state association. There's nothing unethical about helping your patient to afford services such as yours, and what's even more important, with proper budget financing, you don't have to act as your patient's banker.

So we say again, consider your patient's visual welfare in the light of his vocational **and** general needs. You may be pleasantly surprised to find that the concept of multiple pairs of glasses will not only enhance your professional reputation, but also make your work more rewarding. **That's** what we mean by "The Right Eyewear At The Right Time".

LIBERTY • Newark 2, New Jersey

In every detail . . .

SPOKESMAN 520

a superb new heavyweight by Liberty . . . of course!

Only the SPOKESMAN offers impeccable, *hand-tailored* features like these *(see detailed illustration below)* . . .

1. TAPER-GEM Front (Side View): Of dual-stock weight, showing perfect miter of tapered front and temple — both with *embedded* shield.

2. ULTRA-FIT Bridge: One-piece *contour* construction eliminates paste-on pads. Rests with utmost ease *precisely* where zyl meets nose.

3. KING-TAPER or STRAIGHT-BACK Temples: Both off-shoots of the famed *broker* SPATULA — sturdy, durable and *all* man!

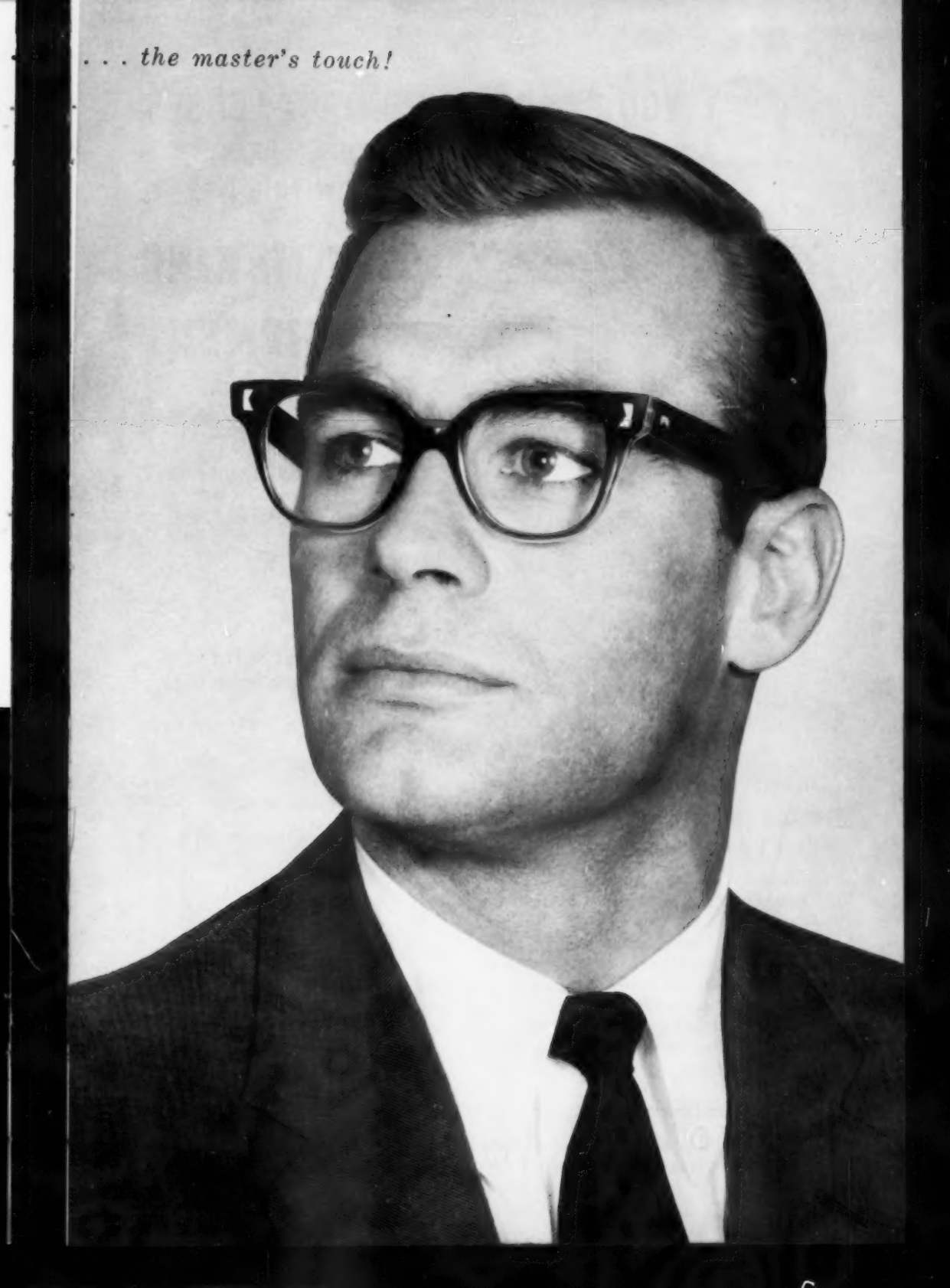
4. SUPER-7 Hinge: Geared for rugged usage, this 7-barrel is *vertically* pinned for added strength.

5. TAPER-GEM Front (Top View): Highlighting the *brow-formed* inner portion of the #520 frontpiece.

Sizes: 44/20-22-24, 46/20-22-24, 48/20-22-24. Solid Colors: Brownsmoke, Gunsmoke, Black. *Two-Tone Colors:* Brownsmoke, Gunsmoke. *Temple Lengths:* 5½" thru 6¼" L.O.

LIBERTY OPTICAL MANUFACTURING CO., INC. • 21 Beach Street, Newark 2, N. J.

. . . the master's touch!



YOU CAN MAKE CONTACT LENSES

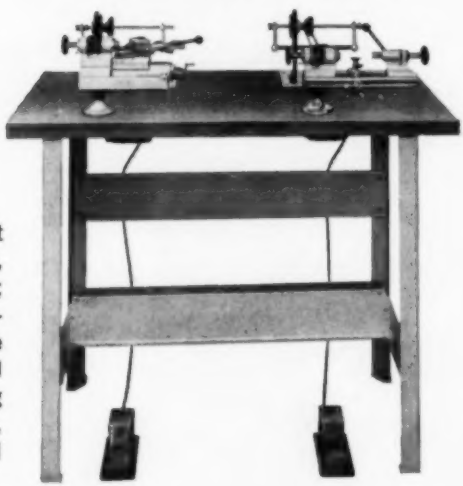
and CONTROL RADIUS OF CURVATURE

SPHERICALLY ACCURATE TO WITHIN 0.01 mm

WITH

LEVIN ® LENS MAKING EQUIPMENT

USED WHEREVER THE VERY FINEST CONTACT LENSES ARE BEING MADE



AN INVESTMENT OF $2200

WILL OPEN NEW PROFIT HORIZONS...

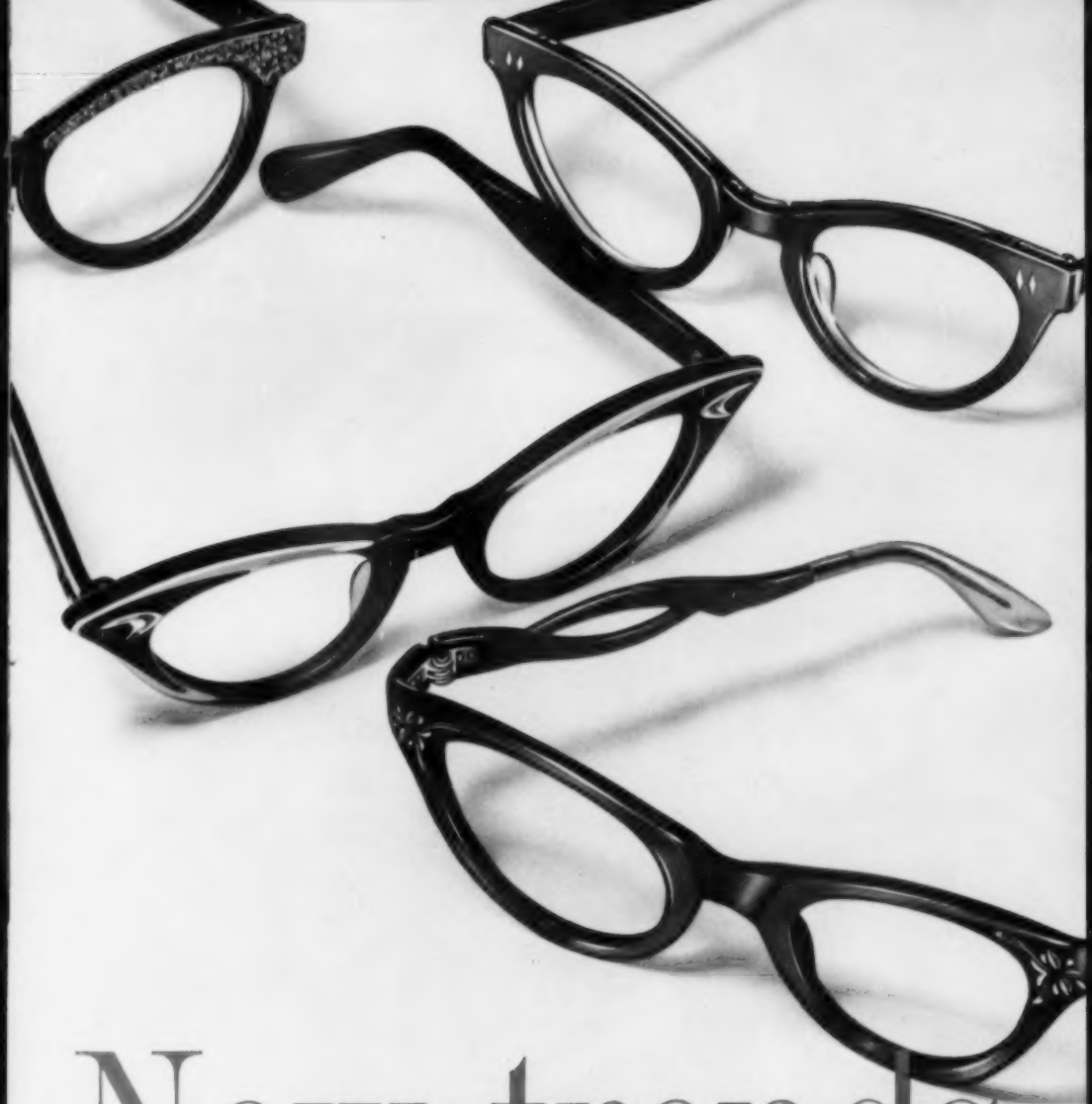
HERE'S WHAT YOU GET:

A Radius Turning Machine, Instrument Lathe, Bench, 2 Motor Drive Units, Laps, Arbors, Molds, Micrometer, Thickness Gage; lens blanks, polish, pitch, and all the accessories necessary to produce lenses which are free from scratches, aberrations, prism, and cylinder. If you are interested in producing lenses which are exactly as prescribed, lenses which are the very finest, write for full information today.

Send for special descriptive literature on radius turning machine, laboratory tools and accessories

LOUIS LEVIN & SON, INC., 3610 South Broadway, Los Angeles 7, California

"MAKERS OF WORLD'S FINEST WATCHMAKERS LATHES"



New trends
in high fashion
eye fashions

1

2

3

Introducing...

FOUR EXCITING NEW FRAMES

by American Optical COMPANY

- Each is an AO Showpiece Design
- Each has been MARKET-TESTED to assure ready patient acceptance

1 MAYAN... exotic all-aluminum classic inspired by art of an ancient civilization. The beautiful tone-on-tone aluminum treatment combines high lustre with hand-engraved, satin-textured overscoring. Swept-back endpieces add drama—and rear-positioned hinges minimize lens breakage. In "patient-preferred" shades of Jet, Mink, Chocolate and Grey Mist. Sizes: 44—20, 22; 46—20, 22. Temples: 4¾, 5, 5¼.

2 ACCENT... sculptured to flatter the features. Contrasting colors plus leaf-designed trim accent the upswept lines. Colors: Feather Brown, Feather Grey, Snow Raven, Spice Flake, Jet Flake. Sizes: 44—18, 20, 22; 46—18, 20, 22. Temples: 5¼, 5½, 5¾.

3 DOMINO... eye fashion's newest frame for daytime wear. Has unique two-way temples that may be worn either straight or bent to a 1¼" drop. Features simple, moderately upswept lines, exquisitely crafted trim, and three "deep-dimensioned" colors: Brunette, India and Snowdrift. Sizes: 44—18, 20, 22; 46—18, 20, 22. Temples: 5¼, 5½, 5¾.

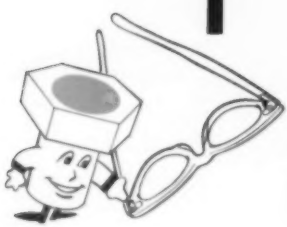
4 ROYAL DOMINO... for those dressier occasions! New nugget-textured aluminum plaques add richness and glamour. Also has the same "two-way" temple featured on the Domino. Three complementing color combinations: Sable plaques on Brunette; Greytone plaques on India; Goldtone plaques on Snowdrift. Sizes: 44—18, 20, 22; 46—18, 20, 22. Temples: 5¼, 5½, 5¾.

All are
AO Red Dot Frames,
of course

Newest trend in Men's Eyewear

THE ROYAL SIRMONT . . .

a distinctive, new look in men's eye fashion—combines the rugged values of a gold-filled chassis with the masculine simplicity of aluminum temples and plaques. Wide-arched, line-engraved bridge flatters the wearer—rocking nose pads provide exceptional comfort. Colors: Gunmetal, Bronze, Brownstone. Sizes: 44—18, 20, 22, 24; 46—18, 20, 22, 24; 48—20, 22, 24. Temples: 5⅛, 5¼, 6.



All the frames shown are AO Red Dot frames. Red Dot temple screws are an AO exclusive—won't loosen, can't get lost—temples stay tight indefinitely! Available through your AO Franchised Distributor or local AO Branch.

American Optical
COMPANY

Since 1833 . . . Better Vision for Better Living

Continental's Great Combination Frame for Men – *Now in Lurium*

Modish, lightweight Lurium top arms and skull temples combine with the stout 1/10 12K gold-filled chassis to bring new lift and polish to the clean-cut good looks of Mansfram, Continental's combination frame success.

Colors, gray and brown. Detachable type crystal pads. Clear crystal temple tips. Eye sizes, 44-46-48. Bridge sizes, 18 to 26.

MEMBER OF UPPER MIDWEST COUNCIL FOR BETTER VISION

MINNESOTA OPTICAL CO.

Exclusive Supplier for the Profession

621 West Lake St., Minneapolis 8, Minn.

Bob Peak
SHURON

Newest in Shuron line of Frames for Modern Men

RONDON in Aluminum

BROWLINE® FRAME

This is the one you've asked for—Rondon Browline® Frame in anodized aluminum! The same younglike styling . . . same "cornering" of bolder, contemporary front into new wide, chevron-embossed Regis temple . . . same time- and temper-saving latch-lock interchangeability of toprims.

You'll like the way Rondon looks in aluminum . . . and your younger patients (and those who would like to look younger) will look the way they like.

In Gunmetal, Ebony, Bronze and Brown—44, 46 and 48mm (18 to 24 bridge) ; 50mm (20 to 24). Shuron Optical Company, Geneva, N. Y., Rochester, N. Y.

FOR THE LOOK THEY'LL LIKE

provide protection for your athlete-patients

with the ALL-NEW

ALL AMERICAN®

ATHLETIC GLASSES

NOW! Reinforced end, for rough use
Expandable, adjustable "Glass Gard" headband
"Cushion Fit" shock absorbent rubber nose piece
Special contoured lenses to fit face
Extra deep eye-wire channel to hold lenses securely
Drop-ball tested safety glass or plastic lenses
ALL-NEW SAFETY DESIGN!

• ALL AMERICAN ATHLETIC GLASSES are a wise investment in eye safety for athletes. These all-new glasses have been designed by BENSON to provide the finest in protection without interfering with performance . . . *assuring complete player confidence!* Note the specific design features above — and you'll agree that your athlete-patients who wear glasses deserve this kind of all-around protection.

Advertisements reaching thousands of athletic coaches and athletes around the country will advise *"Order through your doctor."* Be ready — examine a complete sample at nominal cost. *Write today . . .*

SIZES

44-20
44-23
47-20
47-23

Temples available from 6" through 7" cable.

• specialists in prescription optics since 1913

BENSON OPTICAL COMPANY

Executive Offices • 1812 Park Avenue, Minneapolis

COMPLETE LABORATORIES CONVENIENTLY LOCATED IN UPPER MIDWEST CITIES

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Vol. 36 October, 1959 No. 10

REFRACTIVE TECHNIQUES FOR THE DECREASED VISION PROBLEMS OF THE AGED*

Harry Kaplan†
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

Problems of decreased vision are encountered frequently in the patient over 50 because of normal aging and the existence of degenerative processes which affect the eye. Incipient cataract and senile macular degeneration are probably the two most common causes for decreased vision found in the aged.

The first step in the examination of an older patient who complains of a loss of visual acuity should be to determine whether the cause for the decreased vision is due to a normal aging process or to systemic or eye pathology. After the cause has been established, the patient can be given better treatment from all viewpoints.

IMPROVEMENT OF DISTANCE VISUAL ACUITY

It is often difficult to improve distance visual acuity if a decrease has been caused by the aging processes of the body. Usually, more improvement can be obtained for near acuity than for distance. Obtaining the best distance prescription possible is the first step. Whenever possible, normal refractive procedures should be used to obtain the desired results.

ASTIGMATIC CORRECTION IN REDUCED VISION

Where distance visual acuity has deteriorated to 20/40 or 20/50 or less, astigmatic testing with fan type dials, "T" dials, or Robinson slide may not be valid, except where the cylindrical correction is of a high value (usually above 1.50 D.C.). The lower the visual acuity, the less the ability of the patient to discriminate.

In examining these paients with reduced visual acuity, the amount of spherical fog should be reduced almost to zero in order to give the patient his maximum discrimination ability. Performing the astigmatic test at a distance of approximately ten feet often helps where results would not be obtainable at the customary 20 foot distance.

The keratometric reading is of the greatest aid because it reveals

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 16, 1958. For publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, Fellow, American Academy of Optometry.

the amount of corneal astigmatism present and is strictly an objective test. It is modified, of course, to a small degree by the physiological and/or lenticular astigmatism. In cases where the retinoscopic reflex is blurred because of cloudy media, the keratometric reading may be the only worthwhile clue to any appreciable astigmatic error present.

Performing the astigmatic test with a 2.2X telescopic device in place over the spherical correction plus a small amount of fog (+0.25 D. Sph.) helps many patients to discriminate and to give fairly reliable responses in astigmatic testing. The enlarged image usually increases the discrimination ability of the patient.

The previous astigmatic correction worn is a clue to the astigmatic error present. However, one must be on guard not to be influenced too strongly by the old astigmatic correction. If the decreased visual acuity was present at the time of the last eye examination, then all the previous factors mentioned may have combined to give misleading findings.

Where a good retinoscopic reflex can be obtained, it should be relied upon heavily. It must always be borne in mind that the static retinoscopy finding is the theoretically true refractive error, taking into account all the media of the eye. Where the subjective responses for cylinder differ markedly from the static retinoscopic and keratometric findings, one should be cautious and "lean" toward the objective values rather than toward the subjective findings. Usually, the check tests for power of cylinder, such as the cross cylinder, are not too accurate as a basis for arriving at the proper amount of cylinder.

As a rule, the older patient finds it more difficult than the younger patient to adjust to large changes in the power and axis of the cylinder. Therefore, discretion would dictate that the optometrist temper the larger changes in most cases and take a more "middle of the road" attitude.

Subjectively, many reduced vision patients will grasp for more minus cylinder than necessary because the minus cylinder acts like minus sphere to a certain degree and makes things smaller and blacker. This is interpreted by many patients as being clearer. Therefore, where large differences in cylinder exist between the old prescription and the new findings, only the minimum amount of cylinder should be prescribed consistent with good visual acuity. The retinoscopic and keratometric findings should also be evaluated to determine the final tentative cylinder.

AXIS OF CYLINDER PRESCRIBED IN REDUCED VISION

With reduced vision, the pin-pointing of the axis of the cylinder

may be a difficult task. Again, this is because the discrimination ability of the patient has been reduced. Therefore, subjective responses are usually poor.

The cross cylinder test for axis will not usually work on cylinders under —1.00 or —1.25 D. C. In the higher cylinders, it may work if the visual acuity ranges from 20/40 to 20/70.

The exaggerated cylinder test usually works best for this type of patient. For maximum results, it should be done in a trial frame. This is a monocular test in which approximately —1.00 D. of cylinder is added over and above the tentative distance prescription in alignment with the prescribed minus cylinder. The examiner or, preferably, the patient himself, rotates the axis of the cylinder to the point at which one letter on the visual acuity line is seen darkest, blackest and clearest. For best results, use should be made of a letter containing both a horizontal and a vertical component on a test line one line better than the best visual acuity obtained through the tentative prescription. The test is usually run about three times on each eye as a check for consistency and validity.

SPHERICAL CORRECTION IN REDUCED VISION

The retinoscopic finding, where it can be obtained, should be relied upon heavily. It is the theoretically true refractive error for both the spherical error and astigmatism, taking into account all the refractive media of the eye.

Where cloudy or hazy media exist, it is sometimes possible to obtain a brighter, more interpretable retinoscopic reflex by working at a shorter distance, such as 13″ or 10″. Sometimes an approximate finding can be obtained this way but not at 20″ or 26″.

It is sometimes possible with patients who have blurred media to get a brighter reflex by working with a trial frame or phorometer rather than in a phoropter or refractor. Also, batteries, unless they are brand new, will usually not give as bright a reflex as will a direct electric source with a rheostat control.

SUBJECTIVE RESPONSE

Where the visual acuity has deteriorated below 20/40 or 20/50, the patient's ability to discriminate has been so reduced that most of the normal subjective procedures do not work well. For instance, the red-green test does not usually give good results under these conditions.

The lower the visual acuity, the less is the patient's ability to discriminate. A patient having 20/40 vision may or may not be able to discriminate a ±0.25 D. change. A patient having 20/60 or 20/70 visual acuity usually cannot discriminate the difference of a ±0.25 D.

change. With such patients one must use a ±0.50 D. change before a difference is perceived. Patients having only 20/100 to 20/200 acuity and less, usually cannot discriminate the difference between a ±0.50 D. change. Here a ±0.75 D. or ±1.00 D. change must be used before the patient can tell that a change has taken place.

The use of a 2.2X telescopic lens over the tentative prescription enlarges the retinal image and usually aids the patient's vision and ability to discriminate. The patient can, therefore, discriminate more easily when a change in power is made. Also, the patient usually has the ability to discriminate in a smaller change of power than he would without a telescopic lens in place.

Patients with severely reduced visual acuity cases (20/70 or less), are best tested at 10 feet or closer rather than at 20 feet; this will usually expedite the subjective procedure and give the patient greater confidence. A simple movable Snellen pasteboard chart works well with good overhead illumination.

One surprising observation is that because of greater confidence and motivation at closer distances, many patients will demonstrate a much better visual acuity at 10 feet than they would at 20 feet. Some patients will not make an attempt on the 20-foot chart whereas they do seem to make a greater effort at the shorter distances. Using the "E" and Landolt "C" charts is helpful.

Where cataracts have caused the decrease in visual acuity, there is often a need for increase in minus sphere to compensate for the swelling of the lens. Because of the low discrimination ability of such patients, there is a great danger of overprescribing in minus. These patients tend to grasp for more minus than necessary because the extra minus makes the letters smaller and blacker. This, many times, is mistaken for clearness by the patient.

The minimum amount of minus increase consistent with good acuity should be prescribed. Where large changes in minus are necessary (2.00 D. or more), it is usually best to make the bulk of the change, but to undercorrect to a small degree. For an average patient who can obtain good visual acuity, a small increase in minus lens power is usually accompanied by an immediate improvement in visual acuity. The following chart can serve as an approximate guide for the amount of improvement to be expected in visual acuity by the addition of minus lenses. See Table I.

Where cataracts have caused a swelling of the lens, the amount of minus necessary to get a small improvement in visual acuity may be increased many fold in comparison to the average normal patient. In

TABLE I

Need for Minus Power	Reduced vision without sphere (and correctable to approximately 20/20 with minus sphere).
—0.25 sph.	20/20 to 20/25
—0.50 sph.	20/25 to 20/30
—0.75 sph.	20/40 or 20/50
—1.00 sph.	20/60 or 20/70
—1.50 sph.	20/100
—2.00 sph.	20/200

many cases, 2.00 D. of additional minus are necessary to improve visual acuity only two or three lines. These are patients for whom one must be cautious and prescribe the minimum amount of minus consistent with good visual acuity. Prescribing the full amount of minus causes many of these patients to complain of drawing sensations and other asthenoptic symptoms. In addition, the over-prescribing of minus creates near visual acuity problems which are very difficult to eliminate.

HANDLING OF NEAR CORRECTION FOR REDUCED VISION PATIENTS

The near correction is just as important and sometimes more important for the elderly patient than the distance prescription. More leisure time usually means more time for sewing, reading and hobbies. The demands on near visual acuity can be shown by the following chart:

Near Acuity According to Different Systems of Measurement:

Jaeger	Snellen	AMA	Percentage	Decimal	Point	Reading Matter
1	20/30	14/21	91.5%	0.6	4	Bible and Telephone
3	20/50	14/36	76.5%	0.4	8	Newspaper and Book Print

From this chart we can conclude that a patient must have a minimum of Jaeger 3 or equivalent near visual acuity in order to cope with the normal everyday visual demands. If the patient cannot obtain Jaeger 3 print, he is unable to read newspaper or book print and is performing visually under a definite handicap.

Usually, if an individual is capable of getting from 20/20 to 20/50 distance acuity, he is capable of obtaining a minimum of Jaeger 3 at near. In the mildly reduced visual acuities (up to 20/50), there is usually a very good correlation between distance and near acuity.

Those patients with more severely reduced acuity (20/50 to 20/200 and less), frequently show no correlation between distance and near acuity. Many of these patients will show only a small improvement or no improvement at all for distance vision and yet be capable of obtaining from Jaeger 1 to Jaeger 3 at near.

The following points are some of the practical considerations in

obtaining an improvement in near visual acuity:

Blur-in and blur-out points should be forgotten and improvement of vision only sought. A trial frame should be used and the better eye tested first. Good illumination is necessary. The patient should be instructed to grasp the reading card firmly in both hands and to move it back and forth to reach the point of critical focus.

High plus adds ranging from +3.00 to 15.00 D. should be tried and increased in +1.00 diopter steps until the desired near acuity is obtained. After the desired near acuity is obtained, the power of the add can be refined in ±0.50 D. steps. Usually ±0.25 D. changes are insignificant. After each change of power, the patient is permitted to find the best point of focus by having him move the card back and forth.

The visual acuity at near improves in many cases because of the following reasons: (1) Increased spectacle magnifications. Mag. = Diopters/4. (2) The greater plus add forces the patient to hold reading material closer, resulting in a larger retinal image which is easier to interpret. (3) The larger retinal image stimulates more cones and rods in the macular area, resulting in a greater neurological stimulation.

The net result of all these factors is very gratifying in a great number of patients as it allows their vision to be brought up to Jaeger 3 or better at near.

Most of the higher adds are prescribed monocularly on the better eye because of the close working distances involved. A +5.00 D. add would have a focus point of eight inches, which would cause quite a strain in any attempt for binocular vision. In most patients with reduced vision, one eye is better than the other, and some of the problems of binocular vision are therefore eliminated to a degree.

The minimum amount of plus is prescribed consistent with good comfortable visual acuity. This allows the reading range to be as far from the eye as possible. Most patients do not mind working at closer than ordinary distances if they can see more clearly.

Where patients come close to Jaeger 3, but do not quite obtain it with the higher adds, then these patients would be good candidates for subnormal vision devices. Telescopic devices plus reading caps or microscopic lenses should be tried. Therefore, the high plus add method singles out those patients who might tend to benefit from the use of subnormal vision devices at near.

PRACTICAL CONSIDERATIONS OF PRESCRIBING HIGH ADDS

Some laboratories stock adds up to +5.00 and +6.00 D. Where even higher adds are necessary, the lenses are usually factory ordered, which means a long waiting period and extra expense.

Cement bifocals made in Ultex A form provide one of the best solutions to these problems. There is no appreciable delay, and the expense is little more than for the average bifocal. The cosmetic appearance of the cement bifocal in the higher adds is also better than that of the thicker, fused type of bifocal. Changes in the power of the add, when necessary, are easily made with the cement bifocal, whereas a new lens must be ordered in any of the other types of bifocals.

REFERRING PATIENTS FOR CATARACT SURGERY

Frequent eye examinations are often necessary during the early stages of cataract development. The patient should be advised of the possibility of frequent prescription changes and a definite future check-up appointment should be made. More intelligent referrals can be made if careful records are kept of the amounts and types of changes which are taking place.

Many optometrists refer a patient for cataract surgery only when the cataract has reached a fairly mature point in its development. Others never refer a patient for cataract surgery as long as one eye has good enough vision to take care of the patient's visual demands. Binocular vision is now possible after a monocular cataract operation by the use of a contact lens. Better designs and better fitting of contact lenses have increased their success and acceptance for monocular aphakia among the ophthalmologic surgeons and the public.

One of the points overlooked by many optometrists in referring the patient for cataract surgery is the time element. They say "wait" with the understanding that there is plenty of time. Most senile type cataracts appear in the later age brackets where time is working against the health of the patient. The longer the delay, the greater the number of complications that can occur to make surgery a bad risk because of the poor physical health of the patient. High blood pressure, heart conditions, diabetes and other complications could arise in a few years which might actually prohibit the use of surgery.

Therefore, the attitude of many is changing. They say, "Let's operate on that one eye now while you are a good surgery risk. Even if you do not desire contact lenses, you will get better peripheral vision, and the operated eye can be considered a spare similar to a spare tire in a car." There is merit to this viewpoint, and it should be considered when judging all the pros and cons on whether to recommend or not to recommend cataract surgery for an individual patient.

SUMMARY

Decreased vision problems are encountered frequently in the patient over 50 because of normal aging and degenerative processes which affect

the eyes. Where these problems are encountered, normal subjective procedures and techniques must be modified for best possible results.

To obtain the best astigmatic corrections in decreased vision cases, one should rely heavily on objective techniques such as keratometry and static retinoscopy. Subjective responses are usually poor, especially where only a low astigmatic error exists. The patient's ability to discriminate can be increased by a reduction of the fog to almost zero by working at closer distances such as ten feet, and by the use of a 2.2X telescopic device to magnify the retinal image.

The customary check tests for the power and axis of the cylinder are not usually valid for such patients, again because of the low discrimination ability. An exaggerated cylinder test is very useful to pinpoint the axis of the cylinder and is done best in a trial frame with the patient or doctor rotating the cylinder while the patient views a good acuity letter.

The spherical power of the correction presents the same problems as the astigmatic correction. Again one should lean toward the theoretical refractive error obtained by retinoscopy. The brightness of the reflex can sometimes be increased where cloudy media exist by working at a closer distance than the normal 20″ or 26″. A telescopic lens can also be employed to refine the patient's subjective responses and to enable him to discriminate more easily on the last plus and minus 0.50 or 0.75 D. sphere. Working the subjective at 10 feet will also pave the way to a smoother technique in the more severely reduced vision cases.

Where cataracts have caused a swelling of the lens, the amount of minus increase necessary to get a small improvement in visual acuity may be increased many-fold in comparison to the average normal patient. These are the patients who require only the minimum amount of minus consistent with good visual acuity.

Many patients can be given an improvement in near visual acuity even though there is no significant improvement in distance acuity. This can be done simply by the use of high adds ranging from plus 3 to 15 D. The high adds usually improve near visual acuity by providing greater spectacle magnification and a larger retinal image, which is not only easier to interpret but which also stimulates more rods and cones in the macular area.

Many optometrists have been reluctant to refer patients for cataract surgery as long as the cataract was not mature or the patient had good enough vision in the better eye. One of the points which should be emphasized more strongly in weighing our pros and cons for or against a cataract operation is the general health of the patient. There is no

way of foretelling what the health of the patient will be in the future. The longer the delay the more chance there is that complications may arise to make the patient a poor surgery risk at a later date or actually to prohibit the use of surgery.

TECHNIQUES FOR STABILIZATION OF CHEIROSCOPIC DRAWING WITH SPECIAL REFERENCE TO SERIAL TEST STIMULI*

Phillip R. Haynes† and Cornelia A. Haynes‡
Newark, Ohio

Patients with strabismus are characterized by two main characteristics: the first and most obvious is the motor anomaly and the second is the sensory adaptation[1, 2] which eliminates diplopia. In the treatment of strabismus one must break down the sensory adaptation in order that the patient can see binocularly with normal binocular correspondence before any headway can be made in training motor fusional mechanisms.

One of the simplest approaches to the breaking down of macular and para-macular suppression and the establishment of simultaneous perception and binocular sensory fusion has been through the use of the Maddox Cheiroscope technique.[3a] After the patient has received training to correct the amblyopia, one can proceed with the anti-suppression exercises. The drawing or target is placed in front of the non-suppressing eye, and the suppressing eye views only the hand and pencil tracing of the original drawing. The constant movement of the pencil inhibits suppression and enables the patient to manifest second degree fusion. Where it is difficult to elicit second degree fusion one should utilize the "chase" technique.[3b] A black card is placed in the target holder against which the orthoptist holds a bright toy such as a butterfly on the end of a stick. The image of this butterfly which is viewed by the non-suppressing eye will be projected on to the base of the instrument. The patient now takes a miniature butterfly net placed before the suppressing eye and tries to catch the butterfly, which should when caught appear under the net. Each time the patient catches the butter-

*Submitted on January 17, 1959, for publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist. Fellow, American Academy of Optometry.
‡Orthoptist.

fly, the clinician moves it to another position and the patient proceeds to catch the butterfly again. The constant motion of the butterfly net will tend to break down the suppression. The exercise can be varied by using pictures of a baseball and bat, spoon and dish, or similar targets. This type of exercise provides useful binocular stimulation and has patient interest.

Another interesting procedure uses targets consisting of five large colored circles on a black background. The patient is directed to draw a circle within a circle. This can be modified into a ticktacktoe game by using the common ticktacktoe grid. These procedures are designed to break down suppression and establish first degree fusion.

Giles method of playing snap or other card games is also an excellent technique.[4]

After one has developed first degree fusion then the orthoptist can place the cheiroscopic training target before the non-suppressing eye and proceed with the cheiroscopic drawing. In using this technique the orthoptist is often confronted with the following three major problems which limit its usefulness:

1. There are often changes in the angle of strabismus resulting in a varying change in the directions of projection and spatial localization which hinder the patient's ability to reproduce the test pattern. (See Figure 1.)

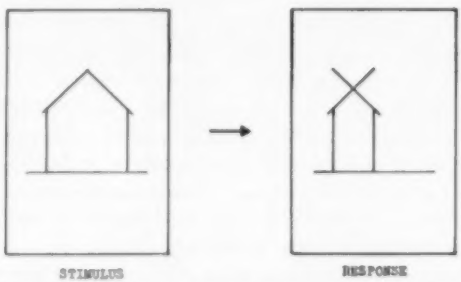


Fig. 1. The figure shows results of a hypothetical patient who monocularly views a cheiroscopic drawing stimulus subtending an angular width of 10 degrees. The patient first reproduced the left half of the house, then there was a spurious vergence change of 5 degrees. Then the subject reprduced the right half of the house. The resultant distorted perceptual-motor response resulting from this instability of the strabismic angle.

2. Target configurations are often so complex that they either are beyond the maturation or developmental level of the young strabismic or they set up such complex border inhibitions at the binocular level that one is confronted with the problem of pitting a normal physiological suppression mechanism against the desired development of stimultaneous

macular perception and fusion.

3. The strabismic patient may alternate from one eye to the other and instead of developing fusion, one is training suppression! The above problems can be minimized or eliminated in many cases by utilizing the following techniques.

The contributing factors to changes in the angle of strabismus can be briefly analyzed as follows: (a) Changes in the magnitude of accommodative convergence resulting from changes in accommodation which are in turn a result of either poorly designed accommodation stimuli or lack of patient concentration and interest. (b) Spurious fusional responses resulting from disparate borders in the two fields of view as well as from other unknown reasons. (c) Changes in tonic convergence. The problem of the stablization of the angle of strabismus can be approached by eliminating or controlling the above factors.

The control of the magnitude of the accommodative convergence is accomplished by placing a high contrast target before the non-suppressing eye. This eye which is usually non-amblyopic and which is the normally used eye is characterized by a well developed control of accommodation. Another important factor arises from an instrument artefact in which the patient is drawing a picture which he knows is at 16 inches but the lens system is designed on a collimating basis which optically sets the target at infinity. This problem can be eliminated by using an open aperture instrument.

The problem of eliminating the spurious fusional responses can be approached by utilizing peripheral fusion stimuli presented to the two eyes.[5, 6] At this stage of training many of the patients may still have deep macular or paramacular suppression but may still manifest sufficient motor fusional responses from peripheral retinal stimuli to maintain the angle of vergence at a constant magnitude. Present techniques are designed to present the cheiroscopic training pattern to one eye and a uniform drawing pad to the other eye, completely neglecting the possibility of using peripheral fusion stimuli. By utilizing small fiducial marks one can identify the right and left fusional stimuli.

The problem of controlling the magnitude of the tonic convergence and related components of convergence is very difficult. However, if one is able to control both (1) accommodative convergence and (2) spurious fusional responses by means of peripheral fusion stimuli then the changes in vergence produced by the change in tonic convergence can be compensated for by compensating fusional responses.

Figure 2 illustrates the use of peripheral fusion stimuli on both the cheiroscopic training pattern and the cheiroscopic drawing sheets.

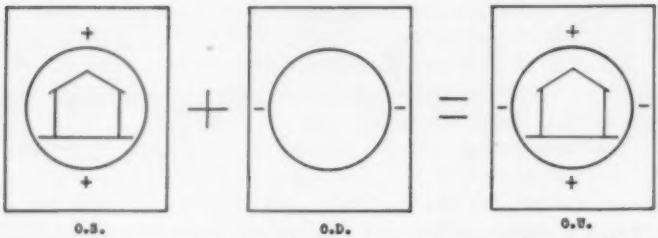


Fig. 2. O. S. represents the visual stimulus to the non-suppressing eye showing the peripheral fusion stimulus and the cheiroscopic drawing pattern. O. D. represents the visual stimulus to the eye manifesting low degree central suppression. The center of this cheiroscopic drawing pad is surrounded by the peripheral fusion stimulus. O. U. represents the perceptual-motor response.

The cheiroscope should be designed so that both the cheiroscopic training pattern and the cheiroscopic drawing sheets can be moved about enabling them to be positioned for various strabismic angles. The author has used patterns based on Brock's Rings, but the exact design can be varied.

In order that the hand will not interfere with the peripheral fusion mechanism the author has used special drawing arrangements which kept the hand out of the field of view. This presents some undesirable problems in regards to the accurate control of the drawing pencil. One can use a beam splitter placed before the one eye which will present both the peripheral fusion stimulus as well as the drawing pad. This will minimize the problem of the hand interfering with the peripheral fusion stimuli.

The actual act of carrying out the cheiroscopic drawing response is a complicated, fine, two dimensional motor task. This type of motor response is classified as a continuous type of serial action.[7] In other words the patient sees a two-dimensional spatial relationship which he tries to reproduce in time. It involves complex perceptual responses as well as complex motor responses.

The second major problem deals with the fact that many clinicians use patterns which are so complex that they are either beyond the maturation or developmental level of the patient, or the complex figures set up a state of confusion because the patient does not know where to start. Many psychological studies[8] have been made to classify drawing ability at various maturation levels and one can refer to these extensive studies to determine the basic principles to follow in the design of cheiroscopic training for patterns for different maturation and age levels. One should recognize the large individual difference between children of a given age group.

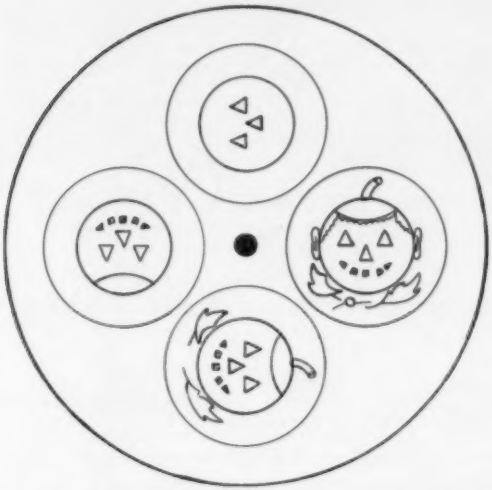


Fig. 3-A. The figure shows a typical serial-test pattern consisting of four separate serial presentations.

A new and unique approach used by the author[9] is the use of the serial stimuli presentation technique. With this technique one can easily proceed from a simplified figure to a complex figure in graded or gradual steps. This is accomplished by using a target like that illustrated in Figure 3. Basically it consists of a wheel containing a series of individual drawings which can be positioned with respect to an open aperture, which is located in the stimulus plane of the cheiroscope. The orthoptist sets the target at position one, which shows a simple object such as a circle. After the patient has drawn the first picture the second position of the target is introduced which contains not only the features of the first presentation but also additional features. Successive steps are presented until the complete figure is presented. This technique has the advantage of simplifying the picture during the initial stages of the drawing, thus minimizing the confusion factor.

Often it is desirable to rotate the target through the various positions so that the patient will have a better feel of the situation. One must remember that the more at ease and the better the rapport, the more efficient the training will be.

The problem of stopping the tendency of the patient to alternate from one eye to the other is often very difficult. One of the most efficient methods is to place a carbon paper and a second sheet of paper below the

Fig. 3-B. The figure shows the serial test-pattern positioned so that presentation number two of figure 3-A is seen by the patient.

blank cheiroscopic drawing pad and have the patient trace the picture with a blunt scribe instead of a pencil. He cannot see what he has drawn and only after the training procedure is finished and one removes the carbon copy, does one know the character of the drawing. This technique eliminates the tendency to copy instead of binocularly tracing because one can not see the copy.

SUMMARY

Cheiroscopic drawing as first introduced by Maddox has several inherent weaknesses. The authors have attempted to point out these and have outlined procedures to correct them. Of special interest are the use of the serial training stimuli and the carbon copy techniques.

53 NORTH THIRD STREET
NEWARK, OHIO

REFERENCES

1. Haynes, Phillip R., Physiological considerations in the development of anomalous retinal correspondence. Am. J. Optom. and Arch. Am. Acad. Optom., 33 (10): 525-536, 1956.
2. Burian, Hermann M., Adaptive mechanisms. *in* Strabismus: a Symposium, edited by Kenneth C. Swan. Rochester, Minn., American Academy of Ophthalmology and Otolaryngology, 1953, pp. 13-26.
3. Lyle and Jackson's Practical Orthoptics in the Treatment of Squint. 4th ed., edited by T. Keith Lyle. Philadelphia, Pa., Blakiston Division, McGraw-Hill Book Co., 1955.
3a. Page 55-58.
3b. Page 79.
4. Giles, G. H., The Practice of Orthoptics. 2d ed. London, Hammond, Hammond & Company, Ltd., 1949.
5. Brock, Frederick W., Visual Training: Preliminary Considerations. Pt. 1. Chicago, Ill., Professional Press, 1949.

6. Ogle, Kenneth N., Researches in Binocular Vision. Philadelphia, Pa., W. B. Saunders Co., 1950, Chapter 9.
7. Seashore, Robert H., Work and motor performance, *in* Handbook of Experimental Psychology, edited by S. S. Stevens. New York, N. Y., John Wiley & Sons, 1951, pp. 1341-1362.
8. Steinbaum, Milton and Mitchell Kurk, The relationship between the Goodenough and Lowder tests, J. Am. Optom. Assn., 29 (8): 521-522, 1957-58.
9. Haynes, Phillip R., Serial Test Patterns for Cheiroscopic Drawing. Unpublished.

THE EFFECT OF HOMATROPINE UPON ACCOMMODATION-CONVERGENCE RELATIONS*

Glenn A. Fry†
School of Optometry, The Ohio State University
Columbus, Ohio

The relation between accommodation and convergence is shown in Figure 1. The phoria line represents the amount of convergence found

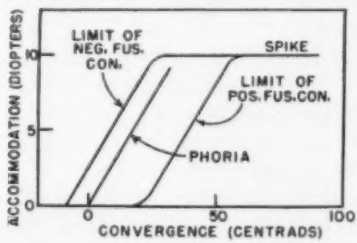


Fig. 1. The relation of accommodation to accommodative and fusional convergence.

at different levels of accommodation when the eyes are "dissociated." If a fusion stimulus is introduced, the eyes can be made to converge or diverge from the phoria position at each level of accommodation so that the lines representing the positive and negative limits of fusional convergence and the zero and maximum levels of accommodation form a parallelogram with rounded obtuse corners and pointed acute corners. At the maximum level of accommodation a subject who has good voluntary control of his convergence can converge his eyes inward much farther than the corner of the parallelogram and this is represented by the spike.

The spike is actually an extension of the phoria line. To demonstrate this one can use a stimulus pattern like that shown in Figure 2. The two small disks are seen by the right eye with narrow beams of

*Submitted on February 12, 1959, for publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist. Ph.D., Director of School. Fellow, American Academy of Optometry.

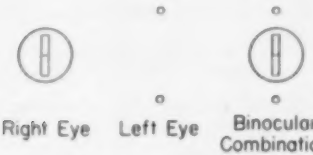


Fig. 2. Targets for measuring the effect of voluntary convergence on accommodation.

light passing through the center of the pupil. The large disk is seen by the left eye with a narrow beam passing through the center of the pupil. The two rectangles are seen by the left eye with narrow beams passing through opposite sides of the pupil and the perceived vertical alignment of these two rectangles is used as the criterion for keeping the stimuli conjugate to the retinas. Because of the narrowness of the beams entering the eyes no blur can be detected when the eyes go slightly out of focus and hence there is no "stimulus" to accommodation. The targets for the two eyes are such that the two eyes are dissociated, i.e., there is no stimulation of fusional movements.

Whatever changes occur in either accommodation or convergence must be induced by voluntary effort on the part of the subject. If the subject has good voluntary control of his convergence he can bring the targets for the right and left eyes into vertical alignment when these targets are adjusted to require different amounts of convergence. At the same time the targets can be moved toward or away from the eyes to measure the amount of accommodation in play. The apparatus required to carry out this kind of experiment has been described in a previous study.[1]

When such an experiment is carried out the various amounts of accommodation associated with the different amounts of convergence plot along the phoria line and the extension of the phoria line which forms the spike. As a matter of fact one can go all of the way to the end of the spike with this kind of experiment.

A simple interpretation of the phoria line and the spike is that accommodation and accommodative convergence are initiated in a common center in the cortex which is subject to voluntary control. Impulses from this center are transmitted to a center in the midbrain and from this point are relayed in two different directions. Some go through the ciliary ganglia to the ciliary muscles and others go to the convergence center where they are relayed to the muscles participating in convergence movements.

A subject can manipulate this mechanism to change the focus of his eyes or to produce any desired amount of convergence within his range.

Along the phoria line each amount of convergence is associated with a different amount of accommodation, but when accommodation reaches its maximum level one can still voluntarily produce additional amounts of convergence without any further increase in accommodation.

It is necessary to suppose that at one of the relay stations on the accommodative side of the mechanism, the output reaches a saturation point while the input is still increasing and while the output in the convergence channel is also still increasing.*

Fig. 3. Targets for investigating the spike with fusion stimuli.

One can also investigate the spike by using fusion stimuli such as shown in Figure 3. The disks are viewed with the natural pupils and the stimulus to accommodation is kept constant at a level of 0.50 D. to 1.00 D. above the maximum accommodative response level. The two rectangles are used to measure the amount of accommodation in play. The two large disks are the fusion stimuli.

As the amount of convergence required for fusion is increased beyond the beginning of the spike, fusion is maintained at first by a combination of fusional and accommodative convergence, but as the near point of convergence is approached, the fusion targets are seen to waver back and forth and it is obvious that convergence is being maintained by voluntary effort and that the reflex fusional mechanism is no longer effective. The maximum amount of convergence found in this test is no greater than that found with the stimulus pattern given in Figure 2 which depends only upon the accommodative convergence induced by voluntary effort.

The experiments recently performed by Van Hoven[2] indicate that the levelling off of accommodation at the higher levels of convergence cannot be attributed to the possibility that beyond this level of accommo-

*This convergence center in the midbrain also receives impulses from a separate cortical center initiating lateral fusional movements. The distribution of impulses to the extra ocular muscles in executing a fusional movement follows the same pattern as in an accommodative convergence movement, i.e., both kinds of convergence produce the same amount of excyclorotation of the eyes along with the convergence. This cyclorotation is absent in simple conjugate movements of the eyes to the right or left.

The innervation from the cortical center controlling accommodation and accommodative convergence must go first to the center in the midbrain controlling accommodation and then to the center controlling convergence. It cannot be vice versa, because impulses from the lateral fusion center in the cortex could also evoke accommodative responses.

dation the lens is completely released from tension from the zonule. An eye which is practically paralyzed with homatropine shows exactly the same kind of levelling off and levelling off at these levels cannot involve a complete release from zonular tension.

The convergence accommodation curves measured by Fincham[3] also show spikes both in a normal eye and in an eye partially paralyzed with homatropine. Since the levelling off occurs at a lower level in the partially paralyzed eye than in the normal eye one can draw the same conclusion from Fincham's data as from Van Hoven's data.

Furthermore Fincham[3] has demonstrated that eserine will increase the maximum level of accommodation. This could not happen if the lens becomes released from zonular tension at a fixed level of accommodation.

From the data presented by Van Hoven for four subjects it is possible to show the relation between the ACA ratio and the amplitude of accommodation as the eyes gradually recover from homatropine. Actually the left eye only was homatropinized, but one can compute the ACA ratio from the accommodative response in the left eye and the associated accommodative convergence of the two eyes. Straight lines have been fitted to the phoria data to evaluate the ACA ratio. When the left eye is almost completely paralyzed the phoria line is non linear, but an attempt has been made to fit a straight line tangent to the phoria line at the lower levels of accommodation. The amplitude of accommodation was evaluated by averaging the accommodative responses at the end of the spike and at 5° and 10° from the end of the spike.

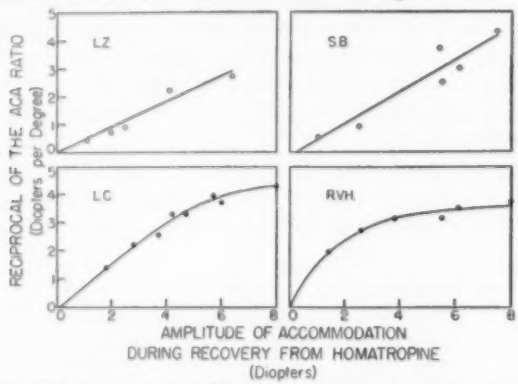


Fig. 4. The change in the ACA ratio during recovery from cycloplegia. (Data for the four subjects of Van Hoven.)

Figure 4 shows the relation of the ACA ratio to the amplitude at various stages of recovery from atropine for Van Hoven's four subjects.

In the case of S. B. and L. Z. straight lines passing through the origin have been used to fit the data, but in the case of R. V. H. and L. C. the relationship is nonlinear. When the amplitude is zero it follows that the reciprocal of the ACA ratio must also be zero. In so far as the data can be fitted by a straight line, this implies that the ratio of the accommodative responses of the two eyes is always proportional to the ratio of the two amplitudes. In other words the homatropine either reduces the number of fibers responding or slows down the frequency of response by the same factor at all levels of frequency.

In the case of R. V. H. homatropine reduces the amplitude of accommodation or lowers the level of the spike without affecting the ACA ratio until the very lowest levels of accommodation are reached. A possible interpretation of this finding is that the homatropine is setting an upper limit to the frequency of responses without affecting the ratio of output to input at lower frequencies. The data for L. C. indicate that we may expect to find a continuous array of relationships intermediate between that of R. V. H. and that of L. Z.

The fact that the amplitude is affected as soon as or before the ACA ratio when homatropine is applied is proof that the lens is under zonular tension at the maximum level of accommodation. As Fincham[3] points out the tension may be less at this level and may permit the lens to be displaced by gravity as demonstrated by Hess[4] or may allow the internal structure to undergo a change as demonstrated by Lancaster and Williams,[5] but this is not at all inconsistent with the possibility that the lens is still able to respond to changes in tension.

The author served as one of the subjects in Van Hoven's study, but data were not taken on the right eye and hence the data could not be treated in the same manner as the data for the other four subjects, but the data can be analyzed in the same way as the data in Figure 4. The data for the author are shown in Figure 5. The line expressing the relationship is nonlinear and lies between that of L. Z. and L. C.

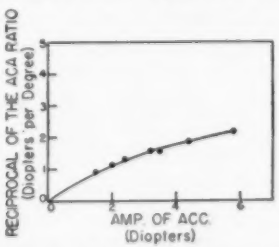


Fig. 5. The change in the ACA ratio during recovery from cycloplegia. (Data for G. A. F.)

The variability of the data is dependent in part upon the fact that other factors than the recovery from homatropine contribute to the variation in the ACA during the 14 to 18 hours required for the experiment. This is shown by the variation in the ACA ratio for the right eye. In Figure 6 the ratios of the ACA ratios for the left and for the

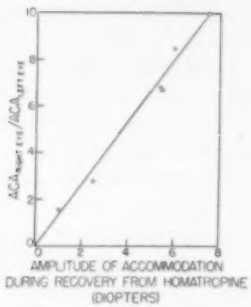


Fig. 6. Data for S. B. in Figure 2 re-analyzed in terms of the ratio of the ACA ratios for the two eyes.

right eye have been plotted against the amplitudes for the left eye for S. B. This yields a much smoother relation than that found in Figure 4.

Morgan[6] performed an experiment similar to that of Van Hoven except that he obtained data for the phoria line only. The phoria lines all terminate at a convergence value of 45Δ (25.4°) where the phoria lines are still sloping. According to Morgan the value for accommodation at the end of each of these lines represents the amplitude of accommodation. Since subjects can voluntarily converge as much as 55° to 65° it might have thrown additional light on the data if the phoria lines had been extended to higher levels of convergence by the procedure described above. It would have been helpful to know where they would have levelled off.

If we take the data at their face value and plot the reciprocal of the ACA ratio against the amplitude of accommodation as shown in Figure 7 we obtain a curve having two segments. We must conclude from this that when Morgan makes a maximum effort to accommodate, there must be a good bit of slack in the zonule which must be taken up before homatropine can affect the form of the lens. There is no evidence for this sort of thing in any of the subjects included in Van Hoven's study.

If we may assume that Fincham's[3] convergence accommodation curves cross the y axes of his graphs at the zero level of accommodation, one may conclude that the slope of the pre-spike portion of the curves bears the same ratio to the amplitude of accommodation in a normal and

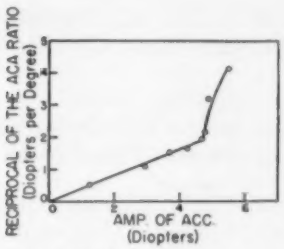


Fig. 7. The change in the ACA ratio during recovery from cycloplegia. (Data for M. W. M.)

in a partially paralyzed state. All of his subjects therefore appear to conform to the pattern set by L. Z. and S. B.

The two subjects investigated by Flieringa and Van der Hoeve[7, 8] showed that the amplitude of accommodation returns to normal after cycloplegia by homatropine sooner than the ACA ratio and thus provided evidence that in some subjects the lens does determine the upper limit of accommodation.

Goldman and Aschman[9] found that accommodative responses of the partially paralyzed eye and a normal eye maintain a fixed ratio at various levels, but this is less than the ratio of the amplitudes of accommodation of the two eyes. This again is evidence that some subjects are limited by the inability of the lens to respond to the ciliary muscle.

REFERENCES

1. Balsam, M. and G. A. Fry, Convergence accommodation, accepted for publication in the Am. J. Optom. and Arch. Am. Acad. Optom.
2. Van Hoven, R. C., Partial cycloplegia and the accommodation-convergence relationship, Am. J. Optom. and Arch. Am. Acad. Optom., 36 (1): 22-39, 1959.
3. Fincham, E. F., The proportion of ciliary muscular force required for accommodation, J. Physiol., 128 (1): 99-112, 1955.
4. Helmholtz's Treatise on Physiological Optics (translated from the third German edition), edited by James P. C. Southall, Vol. 1. Rochester, N. Y., Optical Society of America, 1924, p. 398.
5. Lancaster, W. B. and E. R. Williams, New light on the theory of accommodation with practical applications, Trans. Am. Acad. Ophth. and Otolaryngology, p. 170, 1914.
6. Morgan, Meredith W., Jr., The ciliary body in accommodation and accommodative-convergence, Am. J. Optom. and Arch. Am. Acad. Optom., 31 (5): 219-229, 1954.
7. Flieringa, H. J. and J. van der Hoeve, Arbeiten aus dem Gebieta der Akkommodation, Albrecht von Graefe's Archiv für Ophthalmologie, 114: 1-47, 1924.
8. van der Hoeve, J. and H. J. Flieringa, Accommodation, Brit. J. Ophth., 8: 97-105, 1924.
9. Goldmann, H. and A. Aschmann, Studien über Akkommodation, Ophthalmologica, 111 (2-3): 182-186, 1946.

FURTHER ASPECTS OF BLURRING AND COLOR DISCRIMINATION*

Arthur Shlaifer†
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

This paper represents a further extension of investigations previously reported by the author on the effect of blurring on color recognition.

In the first article,[1] the author demonstrated, under test conditions, that the ability to discriminate color may be eliminated by an appropriate fog of plus spheres. "Binocular reinforcement" was evident in all tests since it required distinctly greater amounts of plus sphere to eliminate color discrimination with binocular vision than it did with monocular vision. Central fixation was obtained in all experiments.

In the second article,[2] the role of binocular reinforcement with central fixation was further explored by inducing various amounts of artificial anisometropia. It was shown that anisometropia of several diopters will weaken the effect of binocular reinforcement. In this report, the results of experiments on blurring and the extra-macular discrimination of color were presented. It was shown under the test conditions that color recognition with central fixation is first obtained with about a 25% greater degree of fog than is obtained at retinal areas 10° nasal and temporal to the fixation point.

In all previous experiments, each colored target was presented separately, nearly always against a white background. The present paper reports results of experiments in which two or more adjacent, centrally fixated, colored targets were to be discriminated under a fog of plus spheres.

A variation of this line of investigation is reported in which the ability of subjects to recognize numbers on color-blindness test plates under a fog of plus spheres was explored.

In the final line of investigation, colored targets were presented for discrimination under a plus fog at a point 5° from the fixation point in addition to the 10° area which has been previously tested.

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 13, 1958. For publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, Ph.D., Member of faculty, Fellow, American Academy of Optometry.

MATERIALS AND METHODS

The subjects in the tests were junior students at Pennsylvania State College of Optometry. They were screened for amblyopia and their basic distance correction was determined. Each subject was screened for color vision defects with the Dvorine test plates.

In obtaining data on the discrimination of adjacent colored targets, the following conditions prevailed: The test objects were red, green and blue squares with 10 mm. sides in the case of the two-color combination and circles of 10 mm. diameter in the three-color combination. The targets were centrally mounted adjacent to each other on 8″ by 11″ sheets of white paper. The targets were held at a distance of 2 meters from the subject, at which point the angle subtended was 17′. Illumination was provided by a 100 watt bulb at a distance of 50 cm. from the targets. The colored test objects were cut from paper of the Heidelberg colors.*

In the procedure, the subject was asked to fixate the target area while a fog of plus spheres was placed over the distance correction before the eye or eyes being tested. The fog was made sufficiently high to eliminate color discrimination before the target was exposed. The subjective impression at this point was usually that of "grayness." The fog was then gradually reduced in 0.25 D. steps until the subject correctly indicated recognition of each color. In some cases, individual colors were identified at the same level of fog or one color was recognized before another. The targets and test conditions were alternated so as to distribute the variables more evenly and rest was permitted during experiments to minimize fatigue. The right and left eyes were tested both separately and together. The color combinations used were red-blue, red-green, green-blue, and red-green-blue. Central fixation obtained.

In the tests on the effect of blurring on recognition of numbers on color-blindness test plates, the procedure was as follows. The plates used were the Dvorine pseudo-isochromatic plates. They were held at a distance of 75 cm. from the subject and were illuminated by a 100 watt bulb at a distance of 50 cm. The right and left eye of each subject was tested both separately and together with central fixation. A fog of plus spheres was placed before the eye or eyes sufficient to eliminate any recognition of the figure or figures appearing on the plate. The fog was then reduced in 0.25 D. steps until the subject first correctly iden-

*In the Heidelberg colors, maximum reflectance is 42% for blue at 460-470 millimicrons; 50% for green at 530-550 millimicrons; and 76% for red at 700 millimicrons.

tified the numbers.

In testing the effect of blurring on extra-macular discrimination of colored targets only the right eye was tested. As a control series, the target was placed in a position for central fixation with a fog of plus spheres over the distance correction so that the color of the target could not be differentiated. The fog was then gradually reduced in 0.25 D. steps until the subject correctly named the color. In the experimental series, targets were presented either at 5° or 10° from the fixation point and in either the nasal or the temporal field. The fogging procedure was repeated. At no time was the target placed so as to be received on the blind spot or so as to occupy an area outside of the normal color field for the subject. In order to distribute variables more evenly, the control series, the experimental series and the order of colors tested within the series were selected at random. The subject was permitted to rest between tests to minimize fatigue.

The data reported in Tables 1, 2 and 3 were obtained at distances ranging from 200 cm. to 75 cm. Accordingly, depending on the level of relaxation of accommodation, the amount of fog might or might not have been the reported level. Nevertheless, relative comparisons may still be made.

The nature of reported tests is highly subjective. In spite of precautionary instruction, there is the element of guessing. Accordingly, results must be evaluated on a qualified basis. The factors of luminosity and chromatic aberration are obviously involved but were not given special consideration.

RESULTS

The data in Table 1 show the effect of blurring on discrimination of adjacent colored targets. The results for right and left eyes are similar. In all cases, the often-demonstrated factor of binocular reinforcement is evident. Binocularly, approximately 30% more plus fog is necessary to eliminate color recognition than is the case when either eye is tested alone.

To evaluate the significance of the results, reference must be made to results obtained in the first paper by the author[1] and summarized in Table 2 of that article. These represent test conditions identical with those reported here except that colors were individually presented against a background of white paper rather than being presented as two or more adjacent colors. A comparison of data indicates that the ability to discriminate any color when more than one is presented contiguous to another reduces the amount of plus fog that can be tolerated by about 30%.

For example, binocularly, a single red square can be discriminated

TABLE 1

Effect of Blurring on the Discrimination of Adjacent Colored Targets

Test distance ..... 2 meters
Targets ..... 10 mm.[1]
N ..... 21[2]

Color Combination		Red		Green		Blue	
		Mean[3]	S.D.[4]	Mean	S.D.	Mean	S.D.
Red-Blue	O.D.	1.73	0.48			1.61	0.50
	O.S.	1.98	0.57			1.90	0.56
	O.U.	2.60	0.66			2.48	0.62
Red-Green	O.D.	1.76	0.46	1.67	0.44		
	O.S.	1.51	0.41	1.52	0.42		
	O.U.	2.46	0.68	2.44	0.61		
Green-Blue	O.D.			1.36	0.38	1.34	0.39
	O.S.			1.78	0.45	1.75	0.44
	O.U.			2.06	0.52	2.28	0.51
Red-Green-Blue	O.D.	1.74	0.47	1.50	0.43	1.70	0.51
	O.S.	1.82	0.48	1.53	0.45	1.74	0.53
	O.U.	2.70	0.64	2.30	0.61	2.54	0.65

[1]Basic dimension. side of square for two-color combination: diameter of circle for three-color combination.

[2]Number of individuals tested.

[3]Mean level of plus fog in diopters at which. with central fixation. color discrimination was definite.

[4]Standard deviation.

with an average fog of +4.00 D. The same is true for a blue square. When both are placed adjacent to each other, an average of about 2.5 D. of plus fog is sufficient to eliminate color recognition for either red or blue square. These results are to be expected since the merging of the blur circles of more than one color should make each more difficult to recognize.

The data from the first article[1] showed results for red, green, and blue that were not different in any statistically significant manner. Sim-

TABLE 2

Effect of Blurring on the Recognition of Numbers on Color-blindness Test Plates[1]

Test distance ..... 75 cm.
N ..... 24[2]

	Plate A		Plate B		Plate C		Plate D	
	Mean[3]	S.D.[4]	Mean	S.D.	Mean	S.D.	Mean	S.D.
O.D.	5.47	1.05	6.18	1.16	5.92	0.98	5.82	0.96
O.S.	5.77	1.10	6.31	0.94	5.81	1.12	6.15	0.98
O.U.	7.40	0.91	8.04	1.02	7.70	1.21	7.49	1.16

[1]Plates used were the Dvorine Test Plates.

[2]Number of individuals tested.

[3]Mean level of plus fog in diopters at which. with central fixation. the number was recognized.

[4]Standard deviation.

ilarly, data in Table 1 show no significant differences for results obtained with either red, green, or blue test objects.

The three-color combination shows results similar to the two-color combinations. It might be expected that results would show the ability to discriminate one of three colors under a plus fog to be slightly lower than the ability to discriminate one of two adjacent colors. At least under the given test conditions, one must assume that the handicap of the additional color was not sufficient to be manifest in the results.

Reference to Table 2 indicates that, under specific test conditions, a monocular fog of approximately 6.00 D. was required to eliminate the ability to recognize the number or numbers on the pseudo-isochromatic plates while binocularly, on the average, about 7.6 D. of plus fog was required. No significant difference obtains between right and left eye data. Binocular reinforcement, however, is clearly evident. With the exception of plate B which required a slightly higher fog to eliminate figure recognition, results obtained with each plate were similar.

On a clinical basis, it may be concluded that, if color vision is tested with pseudo-isochromatic plates and the patient does not wear his spectacle prescription, his ametropia must be of considerable degree before the validity of the results is affected.

TABLE 3

Effect of Blurring on Extra-macular Discrimination of Colored Targets

Test Distance ..... 1 meter
Targets ... circles of 10 mm. diameter
N ..... 20[1]

		Red		Green		Blue	
		Mean[5]	S.D.[6]	Mean	S.D.	Mean	S.D.
Control[2]		6.65	1.67	6.00	1.68	6.12	1.21
5[3]	Temporal	5.92	1.62	4.61	1.52	5.31	1.32
	Nasal	5.70	1.64	4.53	1.48	4.97	1.36
10[4]	Temporal	5.26	1.58	3.75	0.94	4.13	1.24
	Nasal	4.68	1.50	3.75	1.02	4.08	1.15

[1]Number of individuals tested.
[2]Central fixation with O.D.
[3]Target 5 degrees from fixation point of O.D.
[4]Target 10 degrees from fixation point of O.D.
[5]Mean level of plus fog in diopters at which color discrimination was definite.
[6]Standard deviation.

The data in Table 3 indicate that ability to discriminate individual colors under a plus fog is reduced progressively at points 5° and 10° from the fovea. Thus, with red targets and central fixation, an average of 6.65 D. in plus was needed to eliminate color recognition. At 5° from the fovea, and averaging temporal and nasal field figures, the fog needed was reduced to about +5.8 D. At 10° it was still further reduced

to an average of about +4.9 D. Considering the fact that visual acuity at these extra-macular areas is considerably reduced, these results are to be expected. In fact, one might expect that even lower levels of fog would suffice to eliminate color recognition at these extra-macular areas.

The red target in this series is found to require a generally greater plus fog for elimination of color recognition than either the blue or the green target but the differences may simply reflect other factors acting as variables.

Results for the temporal field do not differ in a statistically significant way from results for the nasal field. This contradicts a slight indication from previous results[2] that the nasal field could tolerate a greater amount of plus fog than the temporal at the area tested before color recognition was eliminated.

Another line of investigation which may be pursued in a subsequent report is the effect of blurring on color recognition of subjects with varying degrees of amblyopia.

SUMMARY

Data have been presented which evaluate the effect of blurring induced with plus spheres on ability to differentiate color under certain qualified test conditions. Discrimination of a single colored target against a white background is obtained with a distinctly higher level of plus fog than obtains when two or more adjacent colors are presented against the same background. Pseudo-isochromatic test plates can be differentiated with an average plus fog as high as 6.00 D. monocularly and 7.6 D. binocularly. The ability to discriminate individual colors under a fog of plus spheres is progressively reduced at retinal areas 5° and 10° from the fixation point in both nasal and temporal fields as compared with results obtained with central fixation.

The author wishes to express his appreciation to Ralph Miller and James Quirk, members of the Class of 1958, P.S.C.O., for their assistance.

REFERENCES

1. Shlaifer, Arthur, Blurring and Aspects of Color Discrimination, Am. J. Optom. and Arch. Am. Acad. Optom., 33 (3): 131-142, 1956.
2. Shlaifer, Arthur, Additional Aspects of Blurring and Color Discrimination, Am. J. Optom., and Arch. Am. Acad. Optom., 34 (5): 270-275, 1957.

THE PRINCIPLES OF TONOMETRY—IMPRESSION TONOMETERS*

PART II

John H. Carter†
Division of Optometry, Indiana University
Bloomington, Indiana

INTRODUCTION

Part I of this paper[1] discussed the principles of impression tonometry and has described the most commonly used impression instrument, the Schiotz tonometer.

It is the purpose of the present paper to review a number of commonly encountered variants of the Schiotz. The instruments to be described are the Gradle-Schiotz, McLean, Harrington, Bailliart, Wolfe, and the electronic tonometers.

THE GRADLE SCHOITZ TONOMETER

Figure 4 illustrates the A.O. Modified Gradle Schiotz tonometer. This instrument is an improvement over the older "Standard Model" Gradle-Schiotz instrument developed in 1911.[2a] The Gradle tonometer was initially calibrated by making successive clinical readings with it and the Schiotz. All working parts of the Modified Gradle Schiotz instrument are of stainless steel and hence the tonometer can be sterilized in boiling water.

Unlike the Schiotz instrument which has a zero error of one scale division, [2b] The Gradle Schiotz scale reads zero when the surface of the plunger face is continuous with the surface of the footplate. The Gradle scale readings may be converted into intro-ocular pressure values by an appropriate calibration chart constructed to give the intra-ocular pressure in millimeters of mercury for eyes which may be assumed to have "normal" ocular rigidity. Specifications for the A.O. Modified Gradle Schiotz tonometer have been approved by the Committee on Standardization of Tonometers.[2c] Table I (Part II) lists the June, 1951, specifications.

The critical pressure of a tonometer, or the pressure level at which the footplate comes into total contact with the eye, has been discussed in an earlier paper.[1] Table II (Part II) is a chart showing the critical

---

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 14, 1958. For publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
Part III will appear in the November, 1959, issue. Part I appeared in the September, 1959, issue.
†Optometrist, Fellow, American Academy of Optometry.

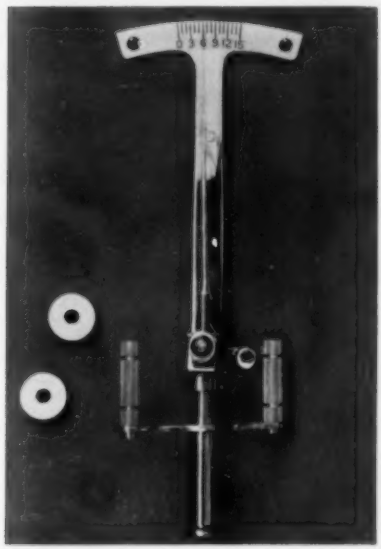


Fig. 4. An A.O. Modified Gradle-Schiotz tonometer shown with its two accessory weights.

pressure values and their corresponding scale readings for the standard and the modified models of the Gradle instrument at each of the available plunger loads.[2d]

A marked advantage of the Gradle Schiotz tonometer is the ease with which it can be positioned accurately upon the cornea because of the small diameter and short radius of curvature of it's footplate. This advantage is somewhat offset, however, by the disadvantage of a relatively high critical pressure and by the fact that the instrument is incapable of accurate tension measurement upon the eyes of abnormally great corneal radius as in buphthalmos.[2e]

THE McLEAN TONOMETER

McLean first introduced his direct reading instrument in 1914 after having voiced several criticisms of the Schiotz tonometer. His objections to the Schiotz were as follows: (1) The scale is too far from the eye under test thus making rapid changes in fixation between the eye of the patient and the scale of the instrument somewhat difficult. (2) Translating the scale reading into mercurial pressure is cumbersome. (3) The Schiotz calibration chart is difficult to decipher. (4) Changing weights is both difficult and time consuming. (5) The plunger

TABLE I

Specifications for A.O. Modified Gradle-Schiotz tonometer (June, 1951)

Weight of tonometer without sleeve assembly	16.5 ± 0.5 gm.
Weight of plunger and pointer assembly, with pointer at scale reading of 7.5 to be	4.76 ± 0.15 gm.
Weight of plunger and spool assembly to be	3.40 ± 0.1 gm.
Weight of individual load weights should be	2.10 ± 0.04 gm.
Corneal sleeve (footplate) dimensions	
Diameter	8.59 $^{+\ 0.03}_{-\ 0.00}$ mm.
Radius of curvature	9.47 $^{+\ 0.08}_{-\ 0.00}$ mm.
Edge corner radius	0.25 $^{+\ 0.10}_{-\ 0.00}$ mm.
Plunger dimensions	
Diameter	2.74 $^{+\ 0.00}_{-\ 0.02}$ mm.
End radius corners	0.20 ± 0.05 mm.
End surface to be flat	
Gauge block dimensions	
Radius of curvature	9.55 $^{+\ 0.08}_{-\ 0.00}$ mm.

Instrument to read zero ± 0.2 scale divisions when placed on its own gauge block. Rotation of spool and plunger must not produce a change of more than 0.4 of a scale division.

Calibration Table

Scale Reading	Tolerance	Plunger displacement (mms.)
0	± 0.2 of a scale division	0
4	± 0.25 of a scale division	0.19
8	± 0.25 of a scale division	0.38
12	± 0.50 of a scale division	0.58

Width of pointer tip 0.25 mm. ± 0.05 mm.

TABLE II

Standard Gradle Tonometer

Load	Critical Pressure	Scale Reading
0	30.6	13
1	32.0	over 15
2	33.3	over 15
3	34.7	over 15
4	36.0	over 15

Gradle — Current Model

Load	Critical Pressure	Scale Reading
0	29.3	10
1	32.0	over 15
2	34.7	over 15

fits the foot barrel so closely that capillary attraction may impair the accuracy of the reading.*

*It may be of interest to note the reply of Schiotz to the criticisms of McLean: (1) The distance between the tonometer scale and the eye is of little importance. (2) Tonometer readings are best stated in terms of weight used and scale reading. Translation of instrument scale reading into mercurial pressure is unnecessary. (3) The calibration chart may be enlarged so as to be more easily read. (4) More reliable indications of

In an attempt to eliminate these "disadvantages," McLean constructed his own instrument so as to differ from the Schiotz in several respects: (1) To move the scale closer to the eye, McLean moved the pointer fulcrum to the superior aspect of his instrument thereby allowing the needle to be directed downward toward a scale attached to the inferior portion of the instrument frame. (2) To eliminate the difficulty associated with translating a scale reading into a pressure value, he calibrated his scale directly in millimeters of mercury, the scale being graduated from 10 to 130. (3) To eliminate the difficulty associated with changing the instrument weights, he used a single fixed plunger load. (4) The plunger was designed to eliminate the "drag" produced by capillary attraction. The physical characteristics of the reference standard McLean tonometer appear in table III (Part II).

TABLE III

Physical Characteristics of the Reference Standard McLean Tonometer:

Weight	
Tonometer without holder	27.0 gm.
Plunger Assembly	
Scale Indication	
10	10.8 gm.
20	11.5 gm.
30	12.0 gm.
50	12.5 gm.
Footplate	
Diameter	10.0 mm.
Curvature	10.0 mm.
Diameter of curved surface	9.5 mm.
Plunger	
Diameter	2.5 mm.
Curvature	Flat
Edge curvature	0.2 mm.
Test block radius	Tonometer Scale Reading
Flat	10.0
Micrometer	Tonometer Scale Reading
0.0	130
0.1	99
0.2	87
0.3	60
0.4	47
0.5	38
0.6	31
0.7	25
0.8	19
0.9	15
1.0	11
1.04	10

intra-ocular pressure are obtained if one is able to alter the plunger load according to the needs of each individual case. (5) The effect of capillary attraction upon tonometer reading is negligible.

McLean did not attempt to base his instrument calibration upon that of the Schiotz as had Gradle, but rather utilized three human eyes and numerous animal eyes in vivo, and also nearly two hundred enucleated eyes in his calibration study.[3] His investigations yielded "normal" intra-ocular pressure values strikingly higher than those which had been found by Schiotz. With the McLean instrument, the lower normal limit of the intra-ocular pressure is considered to be 22 mms. Hg. and the upper normal limit 40 mms. Hg.

Numerous differences in experimental technique between calibration studies of McLean and those of Schiotz no doubt account for the marked discrepancy between their respective estimates of the "normal" intra-ocular pressure. In clinical usage, however, a given McLean reading may be related to a Schiotz value with reasonable accuracy by the use of an appropriate conversion table.

THE HARRINGTON TONOMETER

A relatively recent variant of the Schiotz tonometer is the tonometer of Harrington and Parsons.[4] This instrument has a circular opaque anterior face provided with a solitary window located on its inferior aspect. The window bears a single pointer line etched on its inside surface allowing the underlying scale to be read without parallax error. The scale is activated by a rack and pinion arrangement and itself rotates with alterations in plunger position. The scale is so constructed as to provide a five millimeter separation between Schiotz scale divisions. This is in contrast to the Schiotz instrument in which the corresponding separation is but one millimeter. In addition to its calibration in Schiotz units, the Harrington tonometer is calibrated for use as a direct reading instrument when applied to eyes known or assumed to have a normal rigidity coefficient.

The footplate and plunger tip of the Harrington instrument are constructed of transparent plastic so as to minimize the possibility of corneal injury and so as to allow more accurate positioning of the instrument upon the eye.

Each Harrington tonometer is provided with three charts: (1) A numerical chart for 5.5 and 10 gram weights and also for 7.5 and 15 gram weights computed according to Harrington's modification of the Friedenwald formula for determination of the "true" intra-ocular pressure in presence of an other-than-average coefficient of ocular rigidity. (2) The Schiotz calibration chart of 1924 with interpolation of figures for half scale readings. (3) A numerical chart corrected for average normal ocular rigidity of 0.021 with interpolation of figures for half

scale readings. Table IV (Part II) lists the March, 1952, specifications for the Harrington tonometer.

TABLE IV

Specifications for the Harrington Tonometer (March, 1952)

The specifications are identical to those for the Schiotz tonometer[1] with the following exceptions:

Weight, plunger, lever and pointer at any scale indication	5.5 ± 0.15
Micrometer, at any scale indication	Tonometer scale reading ± 0.25
Wobble, test for fulcrum wobble omitted.	
Back-lash in rack and pinion not to exceed ± 0.2 scale unit.	
Pointer characteristics	
Plunger contact with hammer	No Specifications
Quality of hammer contact surface	
Case	

THE BAILLIART TONOMETER

The Bailliart tonometer differs from those instruments previously discussed in at least two important respects. First, as it is a spring-loaded instrument it may be used with the patient in an erect or a reclining position. Second, it is constructed so as to permit the taking of readings on the sclera or, alternatively, on the cornea.

Like the McLean tonometer, the Bailliart is calibrated as a direct-reading instrument. Thus, the use of tables or charts for the determination of the mercurial value of the ocular tension is unnecessary.

The face of the Bailliart has three scales. The outermost scale is for the measurement of the intra-ocular pressure in millimeters of mercury when the instrument is applied to the sclera. The middlemost scale expresses the mercurial value of the tension for corneal application. The innermost scale consists of three checkpoints, 13, 16 and 19 grams, which are utilized in conjunction with a gravity balance for checking the accuracy of the spring tension operating against the plunger. This tension may be altered, if necessary, by means of a knurled nut located on the plunger shaft within the instrument stem.

The overall weight of the Bailliart instrument is greater than that of the Schiotz, being approximately thirty-one grams. It is lighter, however, than Wolfe Model B and considerably lighter than Wolfe Model C.

The Bailliart tonometer is not provided with a convex test plate as are most impression instruments, but rather is tested for accuracy of plunger setting by positioning the instrument upon a plane surface. Adjustments in plunger position are readily accomplished by rotating the plunger in the appropriate direction.

Berens and Zuckerman[5] point out that the Bailliart instrument may possibly not be as accurate as the usual impression tonometer but

that nevertheless it has several distinct advantages. It may be used where topical anesthesia is contraindicated, when the patient is unusually nervous, and when the cornea is misshapen or otherwise abnormal. Figure 5 shows the Bailliart tonometer to the left of two models of the Wolfe instrument.

THE WOLFE SCLERAL TONOMETER

The Wolfe Scleral tonometer was presented to the optometric profession by the late Dr. Otis Wolfe* of Marshalltown, Iowa. It is a scleral instrument and readings can be obtained on the majority of patients without topical anesthesia.

The Wolfe instrument is essentially a copy of the Bailliart tonometer but presents several minor structural modifications. Figure 5 shows

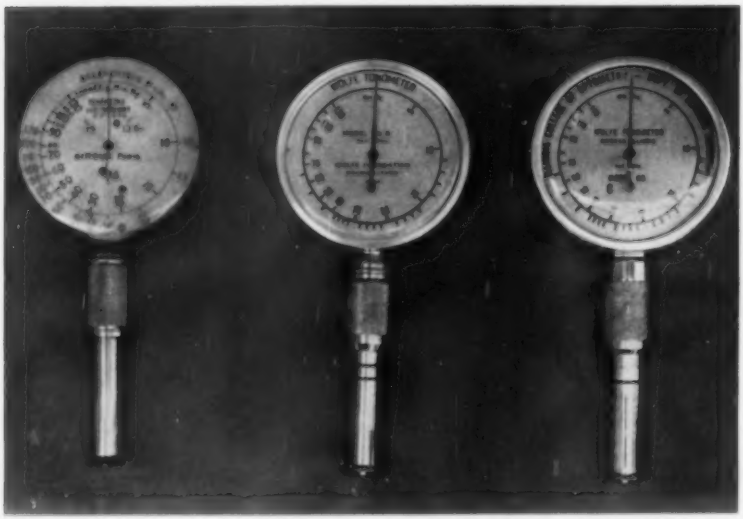


Fig. 5. Three direct-reading tonometers which utilize springs rather than weights and hence may be used with the patient in either a reclining or an erect position. Left—the Bailliart tonometer. Center—the Wolfe Model B tonometer. Right—the Wolfe Model C tonometer.

the Wolfe Model B and the Wolfe Model C instruments along with the earlier Bailliart tonometer.

The Wolfe tonometer is presently being manufactured under the auspices of the Department of Clinical Research of the Illinois College of Optometry. Relatively recent papers by Wick,[6] Hirsch,[7] and Tal-

*Ophthalmologist.

cott[8] deal with the clinical applicability of this instrument.

A subsequent paper in the present series will deal exclusively with the physical, mechanical and functional characteristics of the Wolfe tonometer.

THE ELECTRONIC TONOMETER

Although a mechanical tonometer is well suited for the estimation of the intra-ocular pressure in those cases in which ocular rigidity may be assumed to be normal, its use in estimating the coefficient of ocular rigidity and the "true" pressure in those cases in which rigidity is other-than-normal necessitates the averaging of multiple readings. In addition, the mechanical instrument is not well suited to the technique of tonography in which prolonged application in the presence of occasional small eye movements is necessary, in which extreme precision of estimate is essential, and where the use of an automatic recording device is advantageous.

The electronic instrument, on the other hand, yields readings which are influenced but little by moderate eye movements and is sufficiently sensitive and sufficiently accurate to permit the application of the Friedenwald formula to individual pairs of readings. Further, automatic recording devices are available for use with the electronic tonometer.

Friedenwald has published the following report on the electronic tonometer:[9]

> This instrument conforms in its mechanical features to the Schiotz Tonometer, but, by substituting an electrical for the mechanical system of recording plunger position, does away completely with friction and other mechanical difficulties connected with magnification of the plunger movement. The principle involved in this instrument is quite simple. When an alternating electric current is passed through one element of an induction coil, a corresponding alternating current is set up in the second element. The magnitude of this induced current is dependent upon the intensity of the oscillating magnetic field imposed upon the second element, and is consequently markedly influenced by the presence or abscence of a core of magnetizable metal within the induction coil. In the electronic tonometer an induction coil is placed within the metal (brass) cylinder attached to the footplate while the tonometer plunger, which is part brass and part iron, forms the core of the induction coil. The induced current varies with the position of the plunger, and this induced current, after appropriate electronic amplification, activates an ammeter whose pointer position constitutes the tonometric reading.

Although the electronic tonometer is unquestionably more precise than its mechanical counterpart, some disadvantages are apparent: (1) It is more costly than a certified mechanical instrument. (2) It is somewhat less portable than a mechanical tonometer. (3) The tonometer head cannot be sterilized by flaming, boiling, autoclaving, or soaking in cold solution. (4) Although voltage stabilizing units are available for use with the electronic tonometer, most electronic tonometers not employing these units are quite sensitive to fluctuations in line voltage. (5) Due to thermal drift in the electronic components, warm-up period

is necessary before accurate pressure estimates are insured.

SUMMARY

Since 1905 when the Schiotz tonometer first appeared, numerous variants of this instrument have been developed. Six tonometers of the impression type have been described. Of these, four were designed for corneal use, one for corneal or scleral use, and one for scleral use alone. A subsequent paper* will deal exclusively with the physical, mechanical and functional characteristics of one of these instruments, the Wolfe Scleral tonometer.

JEFFERSON AND GOULD STREET
NASHVILLE, INDIANA

REFERENCES

1. Carter, John H., Tonometry. Pt. I. Principles of tonometry—the Schiotz tonometer. Am. J. Optom. and Arch. Am. Acad. Optom. 36: 1959.
2. American Academy of Ophthalmology and Otolaryngology, Standardization of Tonometers: Decennial Report by the Committee on Standardization of Tonometers. 1954.
2a. Page 93-94 and 100.
2b. Page 96-97.
2c. Page 100-101.
2d. Page 124-126.
2e. Page 153-154.
3. Freiman, George. Clinical study and review of tonometry. Arch. Ophth., 30 (4): 526-546, 1943.
4. Harrington, David O. and Alfred H. Parsons. Tonometric standardization: a method of increasing the accuracy of tonometry. Arch. Ophth., 26 (5): 859-885, 1941.
5. Berens, Conrad and Joshua Zuckerman. Diagnostic Examination of the Eye. Philadelphia, Pa., J. B. Lippincott Co., 1946, p. 336.
6. Wick, Ralph E., Experiences with scleral tonometry. Am. J. Optom. and Arch. Am. Acad. Optom., 33 (3): 118-122, 1956.
7. Hirsch, Monroe J., An evaluation of scleral tonometry: its reliability, validity and clinical applicability. Am. J. Optom. and Arch. Am. Acad. Optom., 32 (8): 391-403, 1955.
8. Talcott, Richard E., A comparison of corneal and scleral tonometry. Am. J. Optom. and Arch. Am. Acad. Optom., 35 (1): 31-36, 1958.
9. Friedenwald, Jonas S., Recent advances in tonometer construction. Trans. Am. Acad. Ophth. and Otolaryngology, 52: 543-547, 1947-48.

*Part III of this report will appear in the November, 1959, issue of this publication.

PRELIMINARY REPORT OF SURVEY ON INTERPROFESSIONAL REFERRAL METHODS*

William G. Walton, Jr.†
Pennsylvania State College of Optometry
Philadelphia, Pennsylvania

The Practice Management Committee of the American Optometric Association in its report to the 1957 Congress announced the development of a patient referral form. This was designed primarily to assist the optometrist with his referrals to ophthalmologists, general medical practitioners, medical specialists, dentists and others.

In several discussions of this form by optometrists the question arose as to how effective it might be. One outgrowth of these discussions was a decision that a study should be made to determine whether or not the desired results were being obtained. Obviously, it would be meaningless to utilize results obtained by one individual or even several individuals; the first step undertaken was an attempt to elicit the assistance of a group of practitioners. Since the author of this report is a native of Pennsylvania and is familiar with optometry in that state, this study has been limited to Pennsylvania optometrists. While this limitation is undoubtedly a weakness in the study, it is felt that Pennsylvania is a typical state with regard to optometric practice.

A letter was written by the author and sent out to a number of Pennsylvania optometrists asking if they would be willing to cooperate in a study of the A.O.A. referral form by using the form and keeping an accurate record of the number of forms used and the number and nature of the replies received. A self-addressed postal card was enclosed for convenience in answering.

The selection of the practitioners contacted was influenced by the following considerations: (1) geographic location in the state, (2) size of community, (3) number of years of practice in the community, (4) whether practitioners were personally known to the author.

In the responses 9.68 per cent of the men expressed regret at being unable to assist the project. The reason given was that the form seemed too formal, inasmuch as these men were accustomed either to sending a written note or to telephoning when referring patients. Because of this

*Read before the annual meeting of the American Academy of Optometry, Boston, Massachusetts, December 16, 1958. For publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist. Member of faculty. Fellow, American Academy of Optometry.

objection it was decided to broaden the survey to include patients referred by any means other than the use of the A.O.A. forms, in addition to those referred by the form. This would seem to offer a better answer to the referral problem as well as a better gauge for the overall effectiveness of the A.O.A. forms.

A total of 62 letters were orginally sent out, with the following results:

43 practitioners or 69.35% signified that they would cooperate.
6 practitioners or 9.68% signified that they were opposed to the A.O.A. form.
3 practitioners or 4.84% signified that they could not assist.
10 practitioners or 16.13% did not answer.

With the broadening of the survey, 49 men or 79.03% of the optometrists approached agreed to assist. All 49 practitioners were then sent a pad of the forms along with a cover letter explaining what data would be of interest for the survey.

GEOGRAPHICAL DISTRIBUTION

In selecting the practitioners, Pennsylvania was divided into six geographical sections. Table 1 shows the geographic distribution of the optometrists who were invited to participate, those accepting, and those later sending in questionnaires. Also shown is the approximate population of the six sections.

TABLE 1

Geographic Section	Optometrists Invited	Optometrists Accepting	Questionnaires Returned	Population of Section
Southeast	29	22	18	4,300,000
Northeast	4	2	1 *1	879,000
South Central	9	7	7	911,000
North Central	2	2	0	477,000
Southwest	13	11	7 *1	3,034,000
Northwest	5	5	2 *2	892,000
	62	49	35 *4	10,493,000

*Unable to report at present time.

SIZE OF COMMUNITY

Table 2 shows the number of optometrists invited to participate, the number accepting, and the number returning questionnaires for communities of various sizes as to population. One practitioner was selected from each community with the exception of Philadelphia and Pittsburgh, where four optometrists were invited from each community.

YEARS OF PRACTICE AND PRACTITIONERS KNOWN TO AUTHOR

All practitioners invited to participate were personally known to the author and all had practiced a minimum of five years in their community.

TABLE 2

Population of Communities	Optometrists Invited (a)	Optometrists Accepting (b)	Number of Communities (a)	Number of Communities (b)	Questionnaires Returned	
5,000 or less	8	7	8	7	5	
5,000 to 10,000	10	8	10	8	7	
10,000 to 25,000	22	17	22	17	11	*4
25,000 to 100,000	11	8	11	8	5	
Over 100,000	11	9	5	5	7	
	62	49	56	45	35	*4

*Unable to report at present time.

RESULTS

Six months after the project was started a preliminary questionnaire (Chart 1) was sent to all men cooperating in the survey. Of the 49 questionnaires sent out, 35 were returned, four men reported that other activities made it impossible for any information to be submitted and 10 men have not replied.

PRELIMINARY QUESTIONNAIRE ON PATIENT REFERRALS

	Number of Patients Referred to by Means of Referral Forms	Number of Replies	Number of Referred to by Other Methods	Number Replies
M. D. General Practitioners				
M.D. Eye				
M.D. Other Specialists				
Osteopaths, Gen. Practitioners				
Osteopaths, Eye				
Dentists				
Other Health Practitioners				

Any Comments and Personal Observations:

Submitted by.....

(Chart 1)

Table 3 shows results obtained by use of the A.O.A. form and by other methods of referrals for (1) general practitioners of medicine; (2) ophthalmologists; (3) other medical specialists and (4) members of allied health professions. These data are broken down as to the numbers sent and the replies received for the various sized communities. In some instance, the community breakdown figures are too small to be of any significance other than to show possible trends. This is also true in

TABLE 3

	5,000 or less				5,000 - 10,000				10,000 - 25,000				25,000-100,000				Over 100,000				Total					
	A.O.A.		Other		A.O.A.		Other		A.O.A.		Other		A.O.A.		Other		A.O.A.		Other		A.O.A.		Other		Total	
	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y	x	y
G.P.			39	9	2	2	28	20	14	9	59	51	13	8	21	7	47	19	31	8	76	38	178	95	254	133
Ophthal-mologists	10	10	38	37	14	9	89	63	43	38	58	56	23	19	98	90	59	44	123	110	149	120	406	356	555	476
Dermatologists													4	3	3	0					4	3	3	0	7	3
Internists													1	1							1	1			1	1
Rhinologists							1	1															1	1	1	1
E. N. T.			1	1					1	1	9	9									1	1	10	10	11	11
Pediatricians									2	2											2	2			2	2
Gynecologists									1	0											1	0			1	0
Neuro-surgeons																			1	1			1	1	1	1
Psychiatrists																	2	2			2	2			2	2
Osteopathic G.P.			5	0			2	2			2	0							7	6			16	8	16	8
Osteopathic Eye							2	2							1	1			1	1			4	4	4	4
Dentists			1	1			4	2	3	1	1	0							6	6	3	1	12	9	15	10
Chiropractors			3	0			5	4															8	4	8	4
Optometrists			2	2																			2	2	2	2
	10	10	89	50	16	11	131	94	64	51	129	116	41	31	123	98	108	65	169	132	239	168	641	490	880	658
	99		60		147		105		193		167		164		129		277		197		880		658			

x Patients referred
y Reports received

the breakdown according to types of medical specialists and to types of allied health practitioners. A total of 880 referrals were made with 658 replies being received or 74.77%. 239 patients were referred using the A.O.A. form with 168 replies being received or 70.29%, while 641 patients were referred by other methods with 490 replies being received or 76.44%. 27.04% of the referrals were made using the A.O.A. form.

Table 4 shows the number of patients referred and the number of replies received by use of the A.O.A. form and by use of other methods and the totals for each of the four major categories of practitioners. In some instances the numbers are too few to do more than signify trends. Where there exist a possibly significant number of referrals, a relatively small difference will be noted in percentage of replies received for the two methods of referring patients. Most referrals were made to ophthalmologists and a difference of 7.14% (A.O.A. 80.54% — other methods 87.68%) is to be found between the two methods. For all referrals the difference between the two methods is 6.15% (A.O.A. 70.29%— other methods 76.44%).

TABLE 4
Referrals

	Total			A.O.A.			Other		
	Sent	Received	%	Sent	Received	%	Sent	Received	%
General Practitioners	254	133	52.36	76	38	50.00	178	95	53.37
Ophthalmologists	555	476	85.76	149	120	80.54	406	356	87.68
Medical Specialists	26	21	80.77	11	9	81.81	15	12	80.00
Allied Practitioners	45	28	62.62	3	1	33.33	42	27	64.29
	880	658	74.77	239	168	70.29	641	490	76.44

Table 5 shows the percentage of replies received for the A.O.A. form, other methods, and totals as related to various sized communities in which optometrists practice.

TABLE 5

Size of Communities	5,000 or less	5,000 to 10,000	10,000 to 25,000	25,000 to 100,000	Over 100,000
% A.O.A.	100.00	68.75	79.69	75.61	60.19
% Other	56.18	71.76	89.92	79.67	78.11
% Total	60.60	71.43	86.53	78.66	71.12

REMARKS AND OBSERVATIONS

Table 6 shows a breakdown as to types of comments received from practitioners as related to the size of communities in which they practice.

Comments favoring A.O.A. form.

"I think the form is a good one."

TABLE 6

Size of Communities	Comments	No Comments	For A.O.A. Form	Against A.O.A. Form	Mixed Reactions	Other Comments
5,000 or less	5	0	1		1	3
5,000 to 10,000	5	2			1	4
10,000 to 25,000	9	2	1	2	2	4
25,000 to 100,000	4	1	1	1	1	1
Over 100,000	6	1	1	1	1	3
Total	29	6	4	4	6	15

"Medical eye men prefer the referral form and appreciate it."

"The referral form has brought excellent comments from the men to whom I referred patients. It was not always returned to me by them but I consider the form excellent in every respect."

"By means of the referral forms the number of replies is greater."

Comments against the A.O.A. form.

"When sending the form for the first time I wrote a cover letter explaining the new form and asking for comments. Replies were that they did not receive enough information and would rather reply by letter in which they could supply more information."

"Knowing the men I refer to personally, the form is not very helpful. We use the phone in my office and they do likewise. I have tried the form out but they call and ask if I am going highbrow."

"I got the feeling that getting a form from me that he had to fill out may have annoyed him. . . . Actually I find the referral forms to be a nuisance and I think the consultant would also find them so. They take time to fill out and I don't think they are, in general, worth the time."

"In this area ophthalmologists and other practitioners rebel at filling out the sheets—too much other paper work at present."

Comments of mixed reactions.

"I feel the referral form is satisfactory except it is too time consuming to use frequently in a busy office. I prefer, in general, to phone the practitioner to whom I am referring a patient unless I do not know him personally."

"Many G.P.'s prefer calling about referrals rather than filling out forms. Some more cooperative than others."

"My pathology referrals have usually been to one man who always mailed me a prompt report. These were more complete in their content than the information he now includes in the new form. No other criticism. Still feel, however, that the form is worth using."

"Some notation should state that further information can be supplied on the back. Granting of permission statement not necessary, in

fact, complicates it."

"Regarding permission for this consultation, doesn't this imply that there might be a reason for the consultant not to send report?"

"Reply received from one M.D. (eye man) for the first time (20 previous trys). However still like a fuller report for some cases."

Other Comments.

"The physicians didn't bother to return forms, but called on the telephone."

(Practitioner who objected to formal form.) "Ophthalmological cooperation in my area is very good. General practitioner cooperation is very bad."

(Practitioner agreed to assist but did not use form.) "We find that there is complete cooperation between the M.D. eye men and us in this locality. We seldom get a report from the G.P. The ophthalmologist always gives us a written report covering the complete case and returns the patient to us for refraction."

(Practitioner agreed to assist but did not use form.) "Referrals are by phone—replies are also by phone, but mostly by letter from eye men."

"All reports from M.D. eye men have been by letter. Reports from other practitioners have been by phone."

(Practitioner who objected to formal form.) "Referrals are made by telephone, unless out of town, then a personal letter is used."

"All referrals to local M.D.'s are made by phone—replies by phone or personal conversation. Referrals to ophthalmologists—same—replies by phone and letter following. . . . I do not approve of having patient sign permission line."

"Referral forms not used due to my calling each referral doctor by phone while patient is in my office. We all agree on an appointment then and there."

(Practitioner who objected to formal form.) "As mentioned befor most local referrals are made by phone as has been the practice before the A.O.A. form was initiated. Since relationships are pretty good I didn't choose to use A.O.A. form. As to the ophthalmologist, I usually get a full report in a lengthy letter and thus wouldn't want to have him change the reply."

"All referrals are made by calling the doctor and making an appointment."

"I have never received a reply from a general practitioner concerning a referral."

"All referrals are made to ophthalmologists by phone and it is

most convenient. A reply comes back by letter if there is no need for patient to return to me and by note by patient if patient returns to me."

"Replies include letters (majority), phone call and at times lab reports."

"On all of the above referrals I received written replies."

"In all cases Dr. . . . mailed me a brief handwritten reply informing me of the treatment that had been instituted."

CONCLUSIONS

Limiting the survey to referrals by Pennsylvania optometrists can be criticized although the author personally feels that Pennsylvania is rather typical optometrically.

The overall results would seem to indicate excellent inter-professional communication between optometrists and ophthalmologists and between optometrists and other medical specialists with only moderate communication between optometrists and general practitioners of medicine and between optometrists and allied health practitioners. The term communication is used rather than the term cooperation inasmuch as there is no question that many members of other health fields cooperate with optometrists in caring for the health needs of the public but for various reasons do not communicate. This is borne out in a sense by the poorer communication shown to exist between optometrists and general practitioners of medicine. This is probably due to the fact that the latter are more accustomed to receiving than sending reports.

While there are a limited number of referrals by means of the A.O.A. form results to date show no significant difference between the results of referrals by that method and those of referrals by other methods. (70.29% to 76.44%.)

It is difficult to draw conclusions from the comments made by the cooperating optometrists with variations from "Medical men prefer the referral form and appreciate it." to "Replies were that they (medical men) did not receive enough information and would rather reply by letter in which they could supply more information."

The author wishes to express his appreciation to Dr. Don Frantz and the members of the Practice Management Committee for making available the necessary forms to conduct the survey. Also appreciation is due to the optometrists who collaborated, for without their assistance this study could not have been made.

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY
Established 1924

Vol. 36 October, 1959 No. 10

EDITORS AND STAFF

Dr. Carel C. Koch ..... *Editor*
Dr. Monroe J. Hirsch ..... *Associate Editor*
Dr. Rudolph Ehrenberg ..... *Advertising Manager*
Terry Judith Parkins ..... *Editorial Assistant*
Grace Weiner ..... *Bibliographic Editor*

Publication and Academy Office: 1508 Foshay Tower, 821 Marquette Ave.
Minneapolis 2, Minnesota

Annual Subscription, United States and Canada, $8.00 in Advance; Foreign, $9.00: Single Copies 80c

Original papers, scientific communications, clinical reports, books for review, and correspondence should be sent to the editor. Subscriptions and applications for single copies should be addressed to the circulation manager. Copy of advertisements must be sent in by the first of the month preceding their appearance. Communications with reference to advertising or other journal business should be addressed to the advertising manager. Academy correspondence should be addressed to Dr. Carel C. Koch, Secretary of the American Academy of Optometry.

Published Monthly by the
AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION

The American Academy of Optometry and the publishers of this journal have no objection to the reprinting by other magazines of any of the articles in this issue, provided such reprints are properly credited to the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

OMA PUBLIC RELATIONS PROGRAM IN 1960

The Optical Manufacturers Association has adopted a resolution calling for contributions from its membership up to one per cent of their domestic ophthalmic sales to provide funds for the first industry sponsored national eye conservation campaign. It is expected that the first year's budget for this campaign will amount to $750,000. This we are sure will be good news to all optometrists. While many of the details still have to be worked out, it is expected that this nation wide public relations program will be under way by the Spring of 1960.

Nearly all of the leading optical manufacturers are members of the OMA and when more of the details of this public relations campaign are ready for publication the names of the contributors will be presented to the profession by the Academy so that all optometrists will know who to thank for this worth while project.

It is now evident that the year 1960 will bring into being this

long needed public relations program directed to calling the nation's attention to the need for more and proper eye care. The Optical Manufacturers Association is to be congratulated for this progressive step and we are confident that all optometrists will support the program to the fullest extent.

RUDOLPH EHRENBERG

THE ACADEMY'S NEW HOME STUDY COURSE—AN INDIVIDUAL AND GROUP OPPORTUNITY

Chapter activities among members of the American Academy have traditionally been rather unorganized and a somewhat loosely knit affair. This is to be expected, as a man is first of all a member of the American Academy of Optometry and secondarily a chapter member.

Chapters in various parts of the United States, Canada and England, however, have distinguished themselves in the past by many fine projects. The Academy is by tradition dedicated to research and professional advancement. Education has always occupied a dominant share of its activities. The new home study course entitled *Synopsis of Glaucoma for Optometrists* is the first of a series of these courses which will offer an excellent opportunity to all organized chapters. Text now in press; cost $5.*

Learning, by the very nature of its activity, must be an individual affair. Great stimuli, however, can be given to study by group participation. The new home study course on glaucoma lends itself ideally to chapter or other group participation. It is hoped that every chapter and optometric study group establishes a review of this course as part of its activities.

Each member of every chapter and study group should subscribe to the course. A part of each meeting could well be devoted to reviewing one of the nine chapters of this course. The selection of a new discussion leader for each meeting would add considerably to the interest and value of this well organized home study course on glaucoma.

RALPH E. WICK

*Published for the Academy by the Burgess Publishing Company, 426 South Sixth St., Minneapolis 15, Minnesota.

SPECIAL REPORT

MYOPIA—FROM THE VIEWPOINT OF A RUSSIAN PHYSICIAN*

TRANSLATED FROM THE ORIGINAL RUSSIAN BY†

Israel Dvorine‡
Baltimore, Maryland

NEARSIGHTEDNESS—MYOPIA.

Nearsightedness is that type of refraction in which parallel rays of light come to a focus in front of the retina. The far point of clearest vision lies in front of the eye at punctum remotum. Three degrees of myopia are usually recognized: weak, no higher than 3.0 D.; moderate, from 3.0 D. to 6.0 D. and high, greater than 6.0 D.

The visual acuity in a nearsighted person is significantly lower: instead of a point focus on the retina, there are circles of diffusion. To decrease them, myopes squint the eyes. This causes a reduction in the dimension of the pupil, the circles of diffusion are decreased and visual acuity increases. Hence the word "myopia," which is derived from the Greek "myo" meaning "squinting" and "ops"—to look. The greater the nearsightedness the lower the acuity. However, there is no rigid relationship between the degree of nearsightedness and visual acuity.

The myope's near point of sharpest vision lies closer to the eye than in emmetropes. The amplitude of accommodation is not great: its range, nevertheless, may be as in emmetropia. However, the majority of myopes do not make use of their accommodation, since they read with their punctum proximum, which lies close to the eyes. For this reason they have to converge to a greater extent which causes the internal recti to tire quickly. As a consequence of the strain, the forehead and the eyes become unsightly wrinkled and (this symptom) is identified as muscular asthenopia. Frequently, the ocular muscles cannot cope with such a strenous effort and one eye turns aside, giving rise to divergent strabismus.

Usually, individuals are born hypermetropic. With the passing of time, some hypermetropes become emmetropes, and others—myopes.

*Submitted on July 22, 1959, for publication in the October, 1959, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Extract translated from *"Diseases of the Eyes"* by N. A. Pletneva, M.D. Published in the U.S.S.R.

‡Optometrist. Fellow American Academy of Optometry.

The transition occurs during the growth of the organism. The eyeball increases along the antero-posterior axis; if the diameter of the eyeball increases to an extent greater than is needed for a point focus on the retina, myopic refraction occurs. The growth of the eyeball usually terminates between 20 and 25 years. The myopia of this period remains stationary for the rest of life. Occasionally one also meets myopia which increases during the entire life and can attain extremely high degrees (20.0 to 30.0 D.). This progressive form of nearsightedness or malignant myopia as it is called, is a serious disease of the membrane of the eye, in contrast to the customary nearsightedness which occurs when there is a discrepency between the refractive power and the long axis of the eye. The progressive form of nearsightedness is a disease, the customary nearsightedness is an aspect of refraction.

The lengthening of the axis of the eye plays the major role in the development of nearsightedness. The increase in the dimension of the eye is reflected in the outer apparance of the eye. The eye is forcefully projected forward, the palpebral aperture appears wider. In addition to these, malignant myopia is usually accompanied with pathological processes in the fundus of the eye: part of which may be explained as an expansion of the posterior section of the eye. An ophthalmoscopic examination of the temporal side of the optic disk discloses a white sickle—crescent. The pigment epithelium in the elongated myopic eyeball does not extend to the side of the optic disk, the vascular membrane is also retracted from the edge of the disk, the sclera is laid bare and gives the impression of a crescent. The crescent effect may also result from the passage of the optic nerve through the scleral canal. The canal has the appearance of a tilted cylinder, owing to the fact that part of the walls of the canal are visible.

The extension of the posterior section of the globe presents an ophthalmoscopic picture of a cone (conus), or posterior staphyloma (staphyloma posticum) and may occur in all types of nearsightedness.

In malignant myopia one sees occasionally irregular bulgings of the sclera, which are separated from the non-protruding part of the sclera by sharp demarcations which carry the ophthalmoscopic term of crescent shaped lines. They are truly posterior staphylomas (staphylomas verum) and fortunately are seldom seen.

The most serious change resulting from malignant myopia is the loss of central vision, inability to read, due to changes in the region of the yellow spot—central chroiditis. The macular changes are not of inflamatory origin but are atrophic changes resulting from severe stretching of the posterior portion of the globe. In the early stage, the oph-

thalmoscope discloses merely thinning of the pigment and then white lines in the region of the yellow spot. With the passing of time, patches of white exudate of irregular form appear in the yellow spot which can spread over an extensive region of the fundus. Often, following hemorrhages and even without hemorrhages, dark patches of exudate develop in the macula. A more serious complication is detachment of the retina.

Among the subjective symptoms of myopia, the most frequent complaint is "flying midges" (muscae volitantes). They can be explained as slight turbidness in the vitreous (embryonic cells) which are found in all eyes. The opacities throw shadows on the retinal membrane. Because of the lengthening of the globe in nearsighted eyes the shadows appear of larger dimensions and are therefore more easily observed by the myope. In progressive nearsightedness the vitreous may actually become turbid, which not only annoys the patient but also the doctor as well, in his investigation of the emerging light. The cause for the turbidness lies in the dilution of the vitreous and in the disintegration of its fibers, forming small flakes.

CAUSE OF NEARSIGHTEDNESS

The onset of nearsightedness occurs during the school years, that is, in the period of life during the growth of the organism and when the eyes carry a greater load.

Researches by F. F. Arisman and A. B. Adamik have shown that as the number of myopes among students increases from year to year, the degree of nearsightedness resulting from close work also increases.

On the basis of these researches F. F. Arizman and other hygienists of the 19th century have established the teaching of the hygiene of students' vision, determined the standard of lighting, designed special kinds of desks, the size of type, etc. The decrease in the number of myopes from the maintenance of these standards justifies one to say that nearsightedness developes following unhygienic conditions when working at close range.

The prevalence of nearsightedness in several generations of certain families led to the erroneous theory of hereditary myopia (Adolph Schtiger, 1913) in which nearsightedness was recognized as a dominant symptom according to Mendelian law. According to this theory nearsightedness depends on a combination of genes whose characteristics are transmitted from parents to children. The point of view of the Morgan geneticists is that the myopic refraction is predestined, and the fight with nearsightedness can only be won through sterilization of persons suffering from progressive nearsightedness. The reactionary nature of Morgan-Weisman-Mendel theory was exposed at the session of Union

Academy of Agricultural Science held on Lenin's birthday in 1948.

It resulted in a brilliant victory for the advancement of native biology of Minchurin. The inherited and transmitted predestined types of refractions was seen in a different light, thanks to the work of Minchurin.

Every living creature makes maximum adjustments to external conditions. Once the found combinations are preserved they are transmitted to descendants when such conditions arise. Therefore, in persons whose eyes of many generations have adopted themselves to non-hygienic conditions at visual tasks, it is especially easy to inherit near-sightedness.

PREVENTION OF NEARSIGHTEDNESS

The aim in the prevention of the development of nearsightedness is to pay the greatest attention to the hygiene of sight, which consists in the removal of unhygienic conditions from the younger generations' work at close range. School hygiene plays the greatest role in the elimination of nearsightedness and aims to establish improved working conditions and to strengthen the young organisms. Of greatest importance is the illumination of the classroom and the pupil's working area. The illumination of classrooms may be considered hygienic if the coefficient of the natural illumination is equal to 1.25 to 2%. The standard illumination of the pupils working area, for example, classroom blackboard, appears to be 100 to 200 foot candles of light. The desks should conform fully to the dimensions of the pupil's body. It is necessary to pay attention to the duration of the work, on the type of lettering, the paper, etc.

Of no lesser significance in this respect is the correction of near-sightedness with lenses. The myope must wear spectacles constantly and these must fully correct his myopia. The wearing of lenses which do not fully correct the nearsightedness will cause myopia to progress as in the absence of a correction. The full correction and the constant wearing of spectacles halts the progression of myopia.

In low grade myopia the full correction is indicated both for far and near. In those instances where spectacles are first used long after myopia has developed, the full correction for close range seeing is poorly tolerated. With these lenses the patient has to resort to his accommodation, and this disturbs his accustomed accommodative-convergence relationship. Therefore, it is important to correct nearsightedness as early as possible.

A large factor in the prevention of nearsightedness is the systematic dispensary examination of pupils and pre-school age children whose refraction is not normal, long before they provoke complaints from the

children.

In persons with very poor vision, owing to changes in the fundus of the eye, lenses frequently do not improve sight. These types of myopes require medical treatment.

In complications of the fundus (changes in the macula, hemorrhages) it is necessary to give the eye complete rest, forbid reading and heavy physical work. To resolve the local changes it is required to use Dionin in the form of drops, beginning with a 2% solution and ending with 10% solution, gradually increasing the concentration each month.

It is recommended to conduct a series of sub-conjunctival injections of 2 to 5% solution of Dionin or 3 to 5% of saline solution, 0.5 ml per injection (10 to 15 injections during the course of the treatment).

Internal treatment should consist of potassium iodide, a teaspoonful three times a day or Lugolevski's solution.

The curative effect of the potasium iodide is in the removal of fluids from the organism, washing away the pathological products which have accumulated in the diseased organ.

In addition to these, the osmosis therapy is occasionally very effective with the intervenous instillation of a hypertonic saline solution. The introduction of the hypertonic saline solution interveneously produces through osmosis changes of pressure in the cells, tissue fluids and blood, which leads to the strengthening of the metabolism of the fluids in the eye. The removal of toxic products through osmosis from the "stagnant swamp" which is typical of inflamations according to Academician V. P. Filatov, improves the activity of the tissues and the blood circulation within them. The enterance of toxic substances into the general blood stream may be the stimulus for the organism to produce antibodies and fermentations, which are significant in the battle with the agents that cause inflamation.

A good effect can be attained with tissue therapy using V. P. Filatov's method. In tissue therapy intra-muscular injections carry extract of aloe, peloid-distilations (mud distillation), injections of skin, placenta and other cold-preserved tissues. Filatov explains that the favorable action of tissue therapy is produced through the regenerative properties of substances—"biogenetic stimulants" or "conservation factors" which appear in cold-preserved tissues, or in darkness during the period of rebirth. Biologic stimulants entering thus or through other means into the organism, strengthen the function of the cells. This stimulation of the organism's tissue cells promotes the resolution of exudate and strengthens the regenerative processes. In this manner, the action of substances formed in the cold-preserved tissues, stimulates

the micro-organism, which can then more readily manage the disease. In the management of malignant myopia it is necessary to maintain a determined regime: not to tire the eyes (one should not work more than 4-5 hours a day, resting 15 to 20 minutes every hour), to avoid heavy physical labor, straining and vibrations.

TRANSLATOR'S COMMENTS

The writer disclaims responsibility for the archaic style of the prose. Because of the importance of the subject, he translated the text literally word for word, denying himself the translator's privilege of compounding sentences, revising phrases, etc., in order to project not only the exact meaning of the text, but the Russian writer's style as well.

Dr. Pletneva's discourse on the causes of myopia is both classical and typically Russian. Not being satisfied with the lucid anatomical description of the appearance and changes in the eye which are generally associated with myopia, she manages to mix a little Marxian ideology with human biology. Her vituperative statements may have sounded more convincing if she had given a clear explanation of Michurin's biology, especially with reference to her phrase "the found combinations are preserved, etc." In one breath she ridicules the theory of inherited myopia and at the same time she speaks of "it is especially easy to inherit nearsightedness." Is she implying that acquired characteristics are inherited? Even the Russians have abandoned this theory.

Dr. Pletneva's positive statement that the wearing of the full myopic correction will arrest myopia will not find a sympathetic ear among many American optometrists. On the contrary, some optometrists with many years of experience will probably say just the opposite. Although statistical data on the retardation and reduction of myopia is scarce, the general practice in this country has been to slightly undercorrect myopia for distance and either to prescribe a further reduction for close work in the form of an extra pair of spectacles or bifocal lenses. Evidently bifocals for children is not a Russian invention.

Optometrists will agree with Dr. Pletneva's recommendation regarding hygienic condition. Illumination, size of type and posture play important roles in the development and progression of myopia. The suggestion of rest periods each hour and limiting the duration of the visual task to only a few hours a day is simply good common sense. Unfortunately, most myopes are avid readers, generally good students and find their greatest enjoyment in activities which make great demands on their eyes. To limit these activities may be more easily accomplished in a highly regimented country like Russia than in a free society like ours.

2328 EUTAW PLACE,
BALTIMORE 17, MD.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

ANNOUNCEMENT OF PROGRAM FOR AMERICAN ACADEMY OF OPTOMETRY ANNUAL MEETING

December 12-15, 1959, Drake Hotel, Chicago

The program for the coming meeting of the American Academy of Optometry in Chicago is nearly complete. At the present time 36 original papers dealing with optometric practice have been scheduled and several more will be added before the final program is released in November. The papers which are now scheduled are as follows:

An infra-red optometer to study the accommodative mechanism. Merrill Allen, Ph.D., Division of Optometry, Indiana University, Bloomington, Indiana.

Comparison between the Howard-Dolman test and Keystone Multi-Stereo tests. Louis Anapole, O.D., Boston, Massachusetts.

Effect of ophthalmic lens fluorescence on visual acuity. Neal Bailey, Ph.D., Columbus, Ohio.

Magnification considerations in ophthalmic lenses. John Davis, M.S., H. G. Frenald, M.S., Arline Ryner, M.S., Southbridge, Massachusetts.

Optometry in Southern Africa. Frank Dickinson, F.B.O.A., St. Annes-on-Sea, England.

Ophthalmic dispensing—Fashion. Margaret Dowaliby, O.D., Los Angeles College of Optometry, Los Angeles, California.

The new Tropical lens and other visual aids for the partially blind. William Feinbloom, Ph.D., New York, New York.

The influence of orthoptics on the ACA relationship. Merton Flom, Ph.D., School of Optometry, University of California, Berkeley, California.

Lighting and efficient seeing. Sylvester Guth, M.E., General Electric Company, Nela Park, Cleveland, Ohio.

Normal and dichromatic luminosities by the critical frequency method. Gordon G. Heath, O.D., Division of Optometry, Indiana University, Bloomington, Indiana.

A method of measuring accommodative response used with a standard refractor. Frederick W. Hebbard, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

Foveal fixation—Disparity measurements and their use in determining the ARC relationship. Frederick W. Hebbard, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

Instruments to augment vision from vehicles. W. Lewis Hyde, B.S., American Optical Company, Southbridge, Massachusetts.

The foveal light reflex and astigmatism. Paul R. Kent, Cmdr., U. S. Naval Hospital, Great Lakes, Illinois.

The optometrist and public health. G. F. Kintner, O.D., Linden, Washington.

Corneal contours in the general population as revealed by the photoheratonope. Henry A. Knoll, Ph.D., Research Department, Bausch & Lomb Optical Company, Rochester, New York.

Temporary asthenopia following a cylinder axis change—A case report. Henry A. Knoll, Ph.D., Research Department, Bausch & Lomb Optical Company, Rochester New York.

A feasibility study of ultrasonic tonometry. Robert A. Koetting, O.D., St. Louis, Missouri.

Speed reading and visual training. James P. Leeds, O.D., Indianapolis, Indiana.

The effect of fixation conditions on depth-discrimination thresholds at scotopic and photopic illuminace levels. Alfred Lit, Ph.D., Bendix Aviation Corporation, Ann Arbor, Michigan.

The clinical A.C.A. ratios. Leo Manas, O.D., Illinois College of Optometry, Chicago, Illinois.

Myopia control with bifocals. Robert B. Mandell, O.D., Division of Optometry, Indiana University, Bloomington, Indiana.

A dual-pulse high speed infra-red optometer. Elwin Marg, Ph.D. and Niles Roth, Ph.D., University of California School of Optometry, Berkeley 4, California.

The pupil lens—A correction for presbyopia. Bernard Mazow, O.D., Houston, Texas.

The relationship between ametropia, bookishness and androgeny. Meredith Morgan, Ph.D., School of Optometry, University of California, Berkeley, California.

The problem of the specific reading disability. Clarence W. Morris, O.D., Fort Wayne, Indiana.

The confusion of "On K" in corneal lens prescribing. Harold Moss, O.D., Woodbridge, New Jersey.

Change in phorias with magnitudes and time after dissociation. C. B. Pratt, O.D., Pacific University College of Optometry, Forest Grove, Oregon.

The children's perceptual achievement forms—A three year story. Helen Robinson, Ph.D., University of Chicago Reading Clinics, Chicago, Illinois.

The inter-relationship of posture and binocular stress in migraine. Raymond Roy, O.D., Portland, Oregon.

Amblyopia exanopsia—A review of the literature. Max Schapero, O.D., Los Angeles College of Optometry, Los Angeles, California.

Report of three years of vision testing at Columbia University as part of freshman physical program. Melvin Schrier, O.D., New York, New York.

Recent developments in glaucoma. Arthur Shlaifer, O.D., Ph.D., Pennsylvania State College of Optometry, Philadelphia, Pennsylvania.

Refractive findings of 500 consecutive juvenile delinquents. William G. Walton, O.D., Pennsylvania State College of Optometry, Philadelphia, Pennsylvania.

Dynamics of accommodation response of the human eye. Gerald Westheimer, Ph.D., School of Optometry, The Ohio State University, Columbus, Ohio.

The reliability of instruments used to measure the curvatures of contact lenses. B. W. Wild, Ph.D., School of Optometry, The Ohio State University, Columbus Ohio.

In addition to the regular program of the Academy, a Contact Lens Symposium is being arranged by the Contact Lens Section of the Academy for Sunday afternoon, December 13th. This Symposium will

be under the direction of Dr. Robert Graham, chairman of the Contact Lens Section of the Academy.

The detailed programs for the meetings of the five Academy Sections will be announced in November.

Dr. P. N. DeVere, Morgantown, North Carolina, president of the American Optometric Association will be the banquet speaker at the Annual Round Table Dinner of the Academy on Monday, December 14th. Dr. DeVere will present his midyear report on optometric progress at this time.

The dates for the annual meeting are December 12, 13, 14 and 15. All meetings will be held in the Drake Hotel and members are urged to make their hotel reservations at once directly with the hotel.

On December 9, 10 and 11 immediately before the annual meeting, the Academy post graduate courses will be held. Sixty-four specialized courses will be presented by outstanding optometrists and educators. For information on these courses optometrists are urged to write for a twelve-page free booklet in which each course is reviewed and the entire schedule is outlined. Write to Dr. D. G. Hummel, 1318 National City Bank Building, Cleveland, Ohio. All optometrists are invited to enroll in these post graduate courses.

Members of the American Optometric Association who attend these courses may make arrangements to attend the entire annual program of the Academy. Sponsorship may be arranged at the registration desk on Saturday morning, December 12th.

DONALD A. SPRINGER, O.D.
PROGRAM CHAIRMAN

NEW MEMBERS

The following optometrists have been elected Fellows of the American Academy of Optometry. The Executive Council welcomes these new members.

Mr. Chris F. Bruton, 7 Crampton Way, Dublin, Ireland.

Capt. R. R. Buckius, U. S. Army Medical Command, Japan.

Mr. Daniel Frederick Burlingham, Library Court, High St., Ling's Lynn, Norfolk, England.

Dr. William N. Deuberry, 120 Seventh Avenue S., South St. Paul, Minnesota.

Dr. Ferd T. Elvin, 3226 Lakeshore Ave., Oakland, California.

Dr. Nelson Greeman, Jr., 249 E. Hilderbrand, San Antonio, Texas.

Dr. Sidney Groffman, Keystone View Company, 202 East 44th St., New York, New York.

Mr. Norman Hallmark, 720 London Road, Oakhill, Stoke-on-Trent, Staffordshire, England.

Dr. Philip J. Hooten, 4000 "J" Street, Philadelphia, Pennsylvania.

Dr. Mitchell M. Kuhn, Massachusetts College of Optometry, 472 Commonwealth Ave., Boston, Massachusetts.

Dr. Charles A. Leonard, 1911 Beaver Ave., Des Moines, Iowa.

Mr. Evan W. A. Lloyd, Library Court, High St., Lings Lynn, Norfolk, England.

Mr. Ronald F. J. Mallett, 22, Harold Court Road, Harold Park, Romford, Essex, England.

Dr. Michael J. Markow, 135 East Allegheny Ave., Philadelphia, Pennsylvania.

Dr. Francis J. Mills, Jr., 524 N. Washington Ave., Lansing, Michigan.

Dr. Ronald A. Peterson, 6226 N. Broadway, Chicago, Illinois.

Lt. Philip S. Robin, 2796 USAF Hospital, Norton AFB, California.

Lt. Donald J. Robinson, U. S. Naval Hospital, Camp LeJeune, North Carolina.

Dr. Sydney C. Rose, 210 Church St., Belleville, Ontario, Canada.

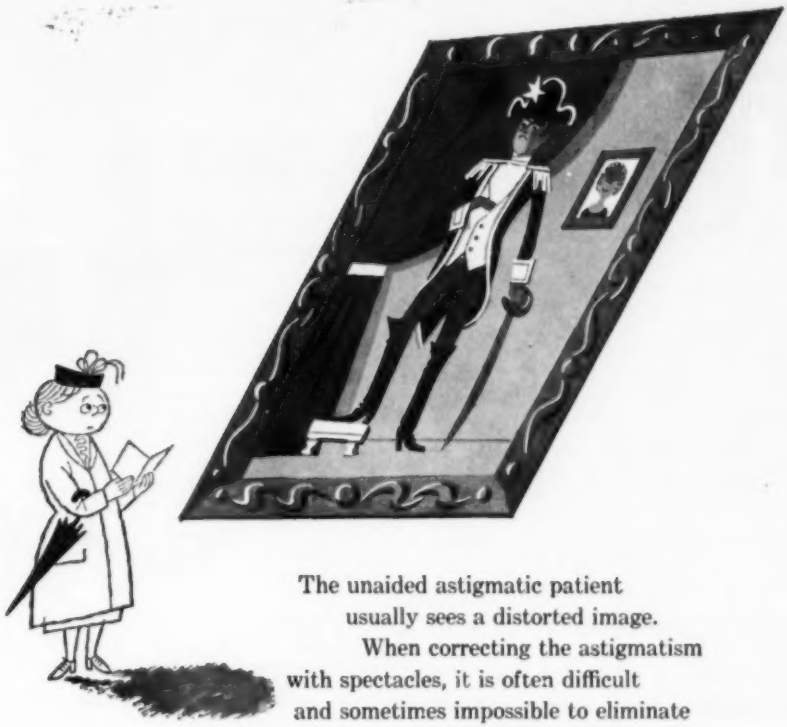
Dr. Morrison Smither, 158½ N. Main St., Suffolk, Virginia.

Capt. Bernard Spendlove, Valley Forge Army Hospital, Phoenixville, Pennsylvania.

Dr. Richard W. Stang, 136 North Main St., Bellefontaine, Ohio.

Dr. Penrhyn Francis Thomas, 49 Market St., Sydney, New South Wales, Australia.

Dr. Edward C. Tobiasz, Illinois College of Optometry, 3241 S. Michigan Ave., Chicago, Illinois.



The unaided astigmatic patient usually sees a distorted image. When correcting the astigmatism with spectacles, it is often difficult and sometimes impossible to eliminate the distortion because of the distance between the spectacle lens and the cornea.

Astigmatism

But contact lenses, due to their location, lessen meridional magnifications and thereby relieve image distortions. Also, by making the front surface of the precorneal fluid spherical, the astigmatism is corrected. The patient will be able to view objects with maximum clarity and minimal distortion.

To the center of your contact lens problem

THE CONTACT LENS CIRCLE

the Plastic Contact Lens Company

Dedicated to Knowledge and Research

5 South Wabash Ave. • Chicago 3, Illinois

NOVEMBER IS NATIONAL CONTACT LENS MONTH

sponsored by the EYE RESEARCH FOUNDATION

Almost without exception, patients fitted like the comfort derived from the lenses.

One in a series of professional evaluations of Therminon Lenses. Name and address on request.

Therminon LENSES

THERMINON LENS CORPORATION • 63RD AT UNIVERSITY • DES MOINES, IOWA

★ **NOW! A NEW "MUST" FOR YOUR LIBRARY**

The A.O.A. offers . . .

***Pre-School* VISION . . .**

Prepared by R. J. Apell, O.D., and R. W. Lowry, Jr., O.D., under auspices of Gesell Institute of Child Development. Hard bound 189-page book written from developmental viewpoint. Diagnostic procedures, techniques and observations in six basic parts in progressive age sequence, beautifully illustrated handsomely printed. Published by A.O.A.

Sorry! No Copies sent on approval.

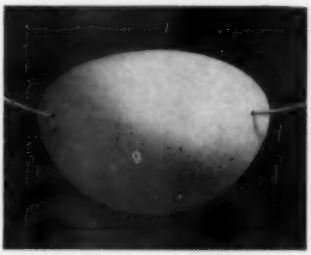
PRICE: $7.50

Send YOUR CHECK OR MONEY ORDER TO AMERICAN OPTOMETRIC ASSOCIATION, 4030 CHOUTEAU AVE., ST. LOUIS 10, MISSOURI

WATCHEMOKET
optical accessories

"STANDARD OF THE INDUSTRY"

MEDICAL EYE SHIELDS



Made of a plastic which is non-toxic to the skin, these medical eye shields will fit confortably over compress and will fit contours of the orbit with or without compress . . . feather-light . . . furnished with elastic band.

Model #130
Specify color: flesh, pink or black

WATCHEMOKET OPTICAL CO., INC.
232 West Exchange Street • Providence 3, R. I.

ENCYCLOPEDIA OF CONTACT LENS PRACTICE

A Loose Leaf Encyclopedia with Bi-Monthly Supplements

Editor: Phillip R. Haynes, OD., FAAO.

Publisher: Bernard E. Vodnoy, OD., FAAO.

For U.S.A., Its Possessions, Canada and Mexico

Syllabus-Manual of the Encyclopedia (100 Pages) $ 5.00
Six Bi-Monthly Supplements @ 2.75 each 16.50
If Paid In Advance, Total Cost for the First Year 19.50

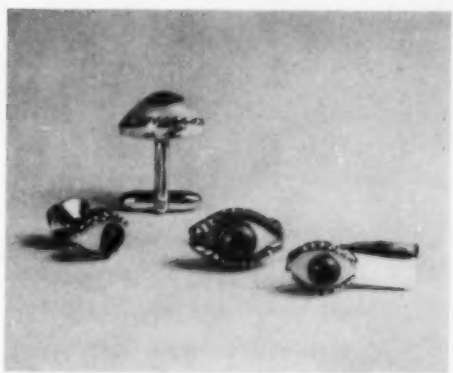
Send Inquiries and subscriptions to the Publisher,
801 No. Michigan
South Bend 1, Indiana

WALCO
SINCE 1915
COMPLETE OPHTHALMIC *Services* to the PROFESSION
☆ *Precision* GRINDING
☆ *Quality* MATERIALS
☆ *Craftsmanship*

CONVENIENTLY LOCATED
St. Paul, Minn. • Austin, Minn. • Bemidji, Minn.
Watertown, S.D. • Grand Forks, N.D.

THE WALMAN OPTICAL COMPANY
229 Medical Arts Building Minneapolis 2, Minnesota
FOUNDED IN NINETEEN HUNDRED FIFTEEN

EXCLUSIVE . . . ORIGINAL



Imported solid glass eyes fashioned by us into men's accessories that are different. Available in Grey, Brown, Green.

Cuff Links, set in sterling silver..... $7.50
Tie Bar, sterling silver..... 4.50
Tie Tack, set in sterling..... 4.00
Tie Tack, without sterling setting (not pictured)..... 2.50
Cuff Links, without setting (not pictured)..... 5.00

HANDCRAFTERS ASSOCIATES
1674 Broadway • New York City 19
Dept. B

SATISFYING RX SERVICE

is the infusion of many important elements

The use only of recognized quality products
Modern equipment and precision machinery
Highly skilled and experienced workmanship
Sales policies constructive for the Profession

The maintenance of a rigid inspection system in the processing of your prescriptions
A personal friendly Rx service adapted to your Optometric needs

TWIN CITY OPTICAL COMPANY

MINNEAPOLIS MINNESOTA WILLMAR

49 Years of Quality First

PRE-PUBLICATION ANNOUNCEMENT

THE FIRST IN A SERIES OF POST GRADUATE HOME STUDY COURSES
TO BE PUBLISHED BY THE AMERICAN ACADEMY OF OPTOMETRY.

Synopsis of Glaucoma for Optometrists

Arthur Shlaifer, Ph.D., Penn. State College of Optometry

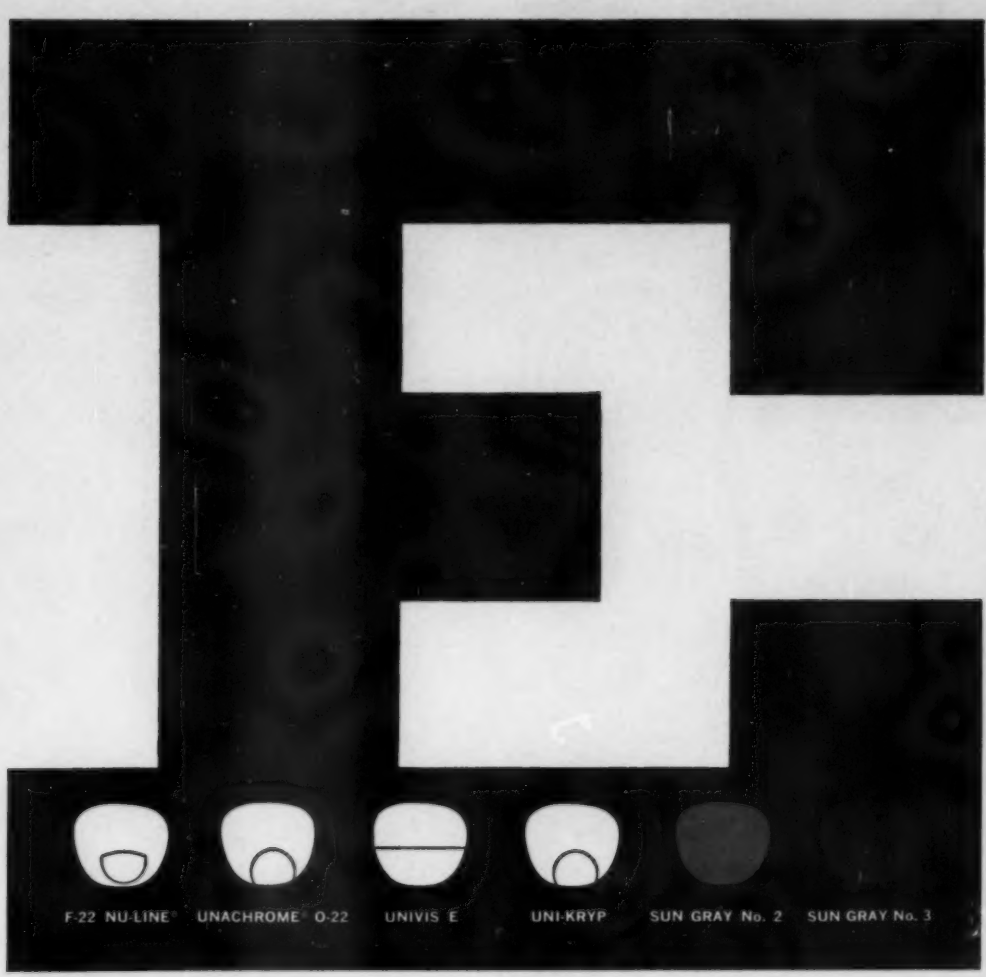
This book is especially written to cover all aspects of glaucoma screening from the standpoint of the optometrist. The author is a specialist in his field and covers the etiology, clinical signs, symptoms and screening tests used to facilitate proper referral.

Synopsis of Glaucoma for Optometrists will be available Jan. 1, 1960; 8½ x 11" size; highly illustrated; board cover; offset printing; $5.00.

SEND FOR YOUR COPY NOW.
CHECK SHOULD ACCOMPANY ORDER.

BURGESS PUBLISHING COMPANY

426 SOUTH SIXTH STREET • MINNEAPOLIS 15, MINN.



KEY letter in vision:

E for excellity*— in the Univis Lens Series and
now in the above lens styles
not formerly available in your Univis Rx's

*A Trademark of **The UNIVIS Lens Company - Dayton, Ohio**

YOU CAN'T SEE IT...
BUT IT'S THERE!

That's the beauty of the new Younger-22 Seamless Lens—it accomplishes all the aims of the ordinary bifocal, yet to anybody on the other side of the lens, it looks like single-vision!

Why is this important to presbyopes? Because the wearer no longer shows the telltale sign of aging: a visible bifocal segment.

No one greets the threshhold of middle-age with equanimity. The only reason a presbyope will accept visible bifocals today is that he or she is resigned to them as the only possible alternative to increasingly poor distance-and-near vision.

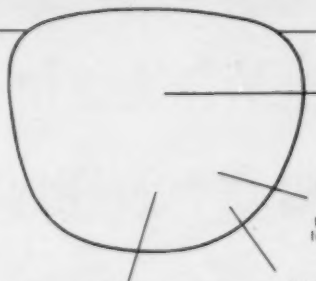
The new Younger-22 Seamless Lens is the first truly-invisible, optical-quality, dual-field lens. Not only is the segment invisible to the beholder; the wearer is not likely to be annoyed by the visible segment line; the soft transition zone between fields eliminates that.

Your presbyopic patients will welcome this ageless dual-field lens; convince yourself by trying a pair at your first opportunity!

The *New* YOUNGER-22 Seamless Lens

YOUR PATIENT TAKES NO RISK with Younger-22s. If the patient cannot wear them for any reason, it will be replaced with a fused bifocal of your choice at no additional cost.

Frame shown: Liberty's famous Broder 215



2. Front surface quality and spherical accuracy to millionths of an inch.

3. Soft transition, greater comfort and less 'bifocal shock' than a fused segment line.

1. 22mm usable segment with power deviation less than .05 diopters (4 Newton rings) — 40% more precise than industry standards.

4. Segment and transition size deviation less than .0125mm, with no chromatic aberration—color-free.

YOUNGER
Los Angeles 15, California